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A study of Farm Security Administration record books from Pennsylvania
MNS# PSt SNPaAg047.2

CONTENTS OF REEL 47
(CONTINUED)

3) Hollen, Evelyn
A study of the dietary habits and nutritional status of school children of different national and racial backgrounds in an anthracite coal region of Pennsylvania
MNS# PSt SNPaAg047.3

4) Jenkins, David Hall
Bob-white cover in Franklin County, Pennsylvania
MNS# PSt SNPaAg047.4

CONTENTS OF REEL 47
(CONTINUED)

5) Righter, C. Arthur
A planting study for the front campus, Pennsylvania State College
MNS# PSt SNPaAg047.5

6) Andes, James
Problems in the basic-surplus plan in the Philadelphia milk shed
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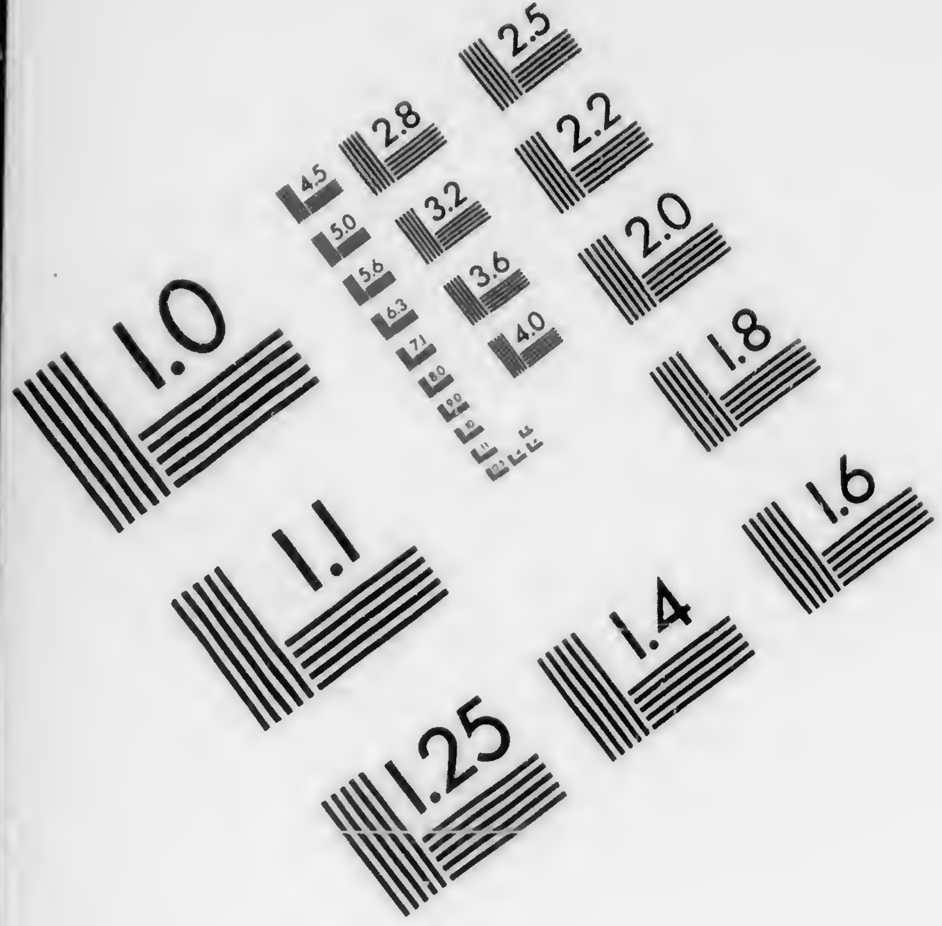

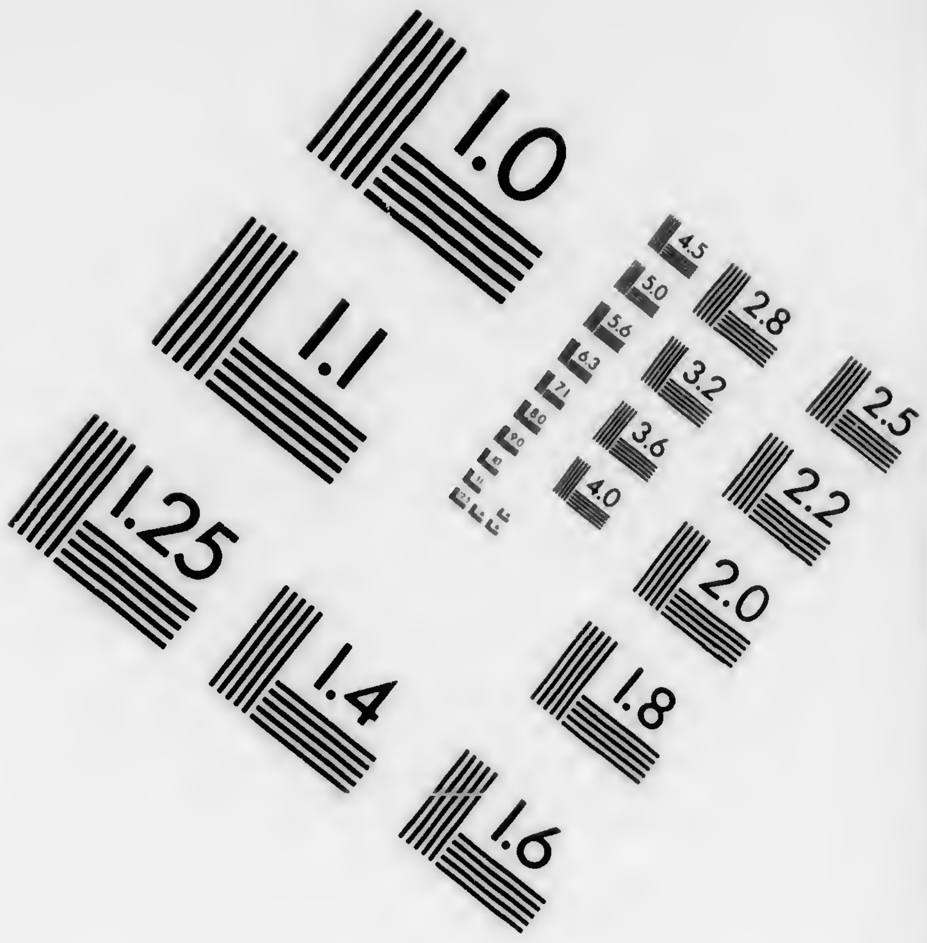

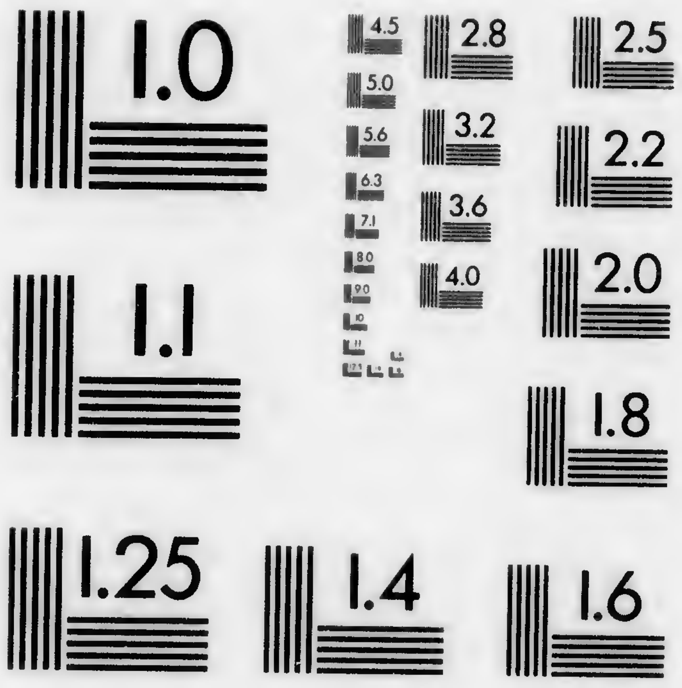

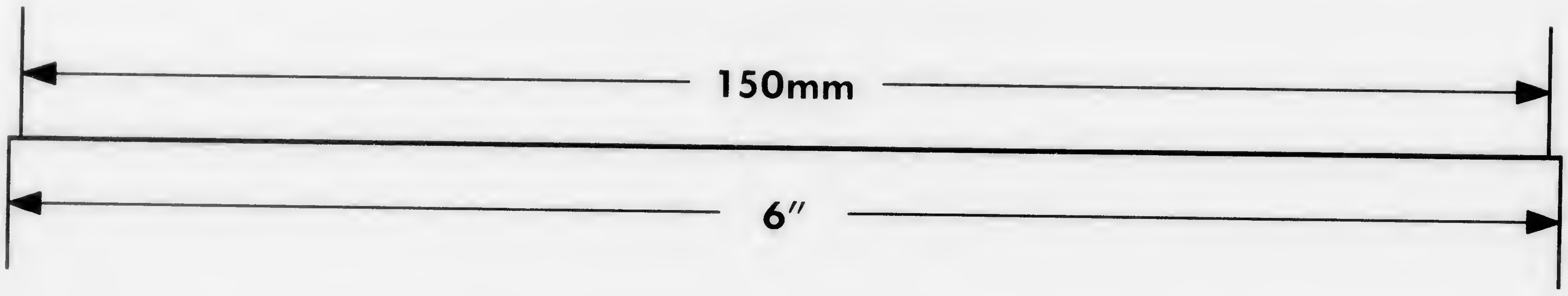

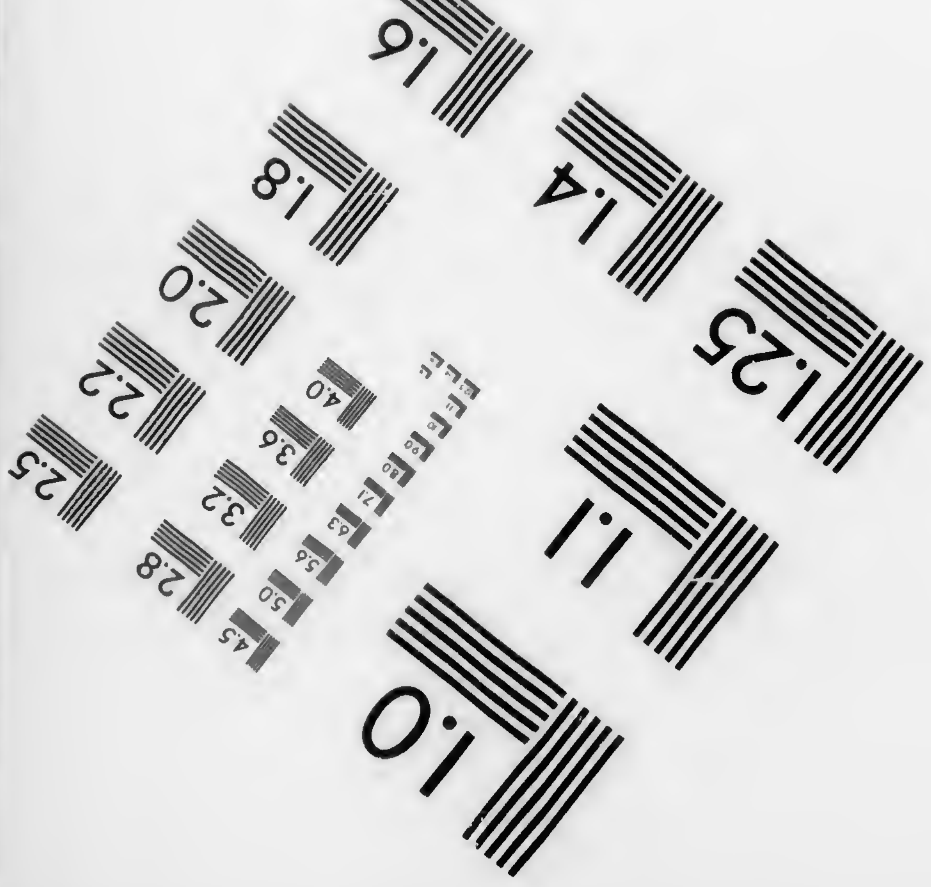

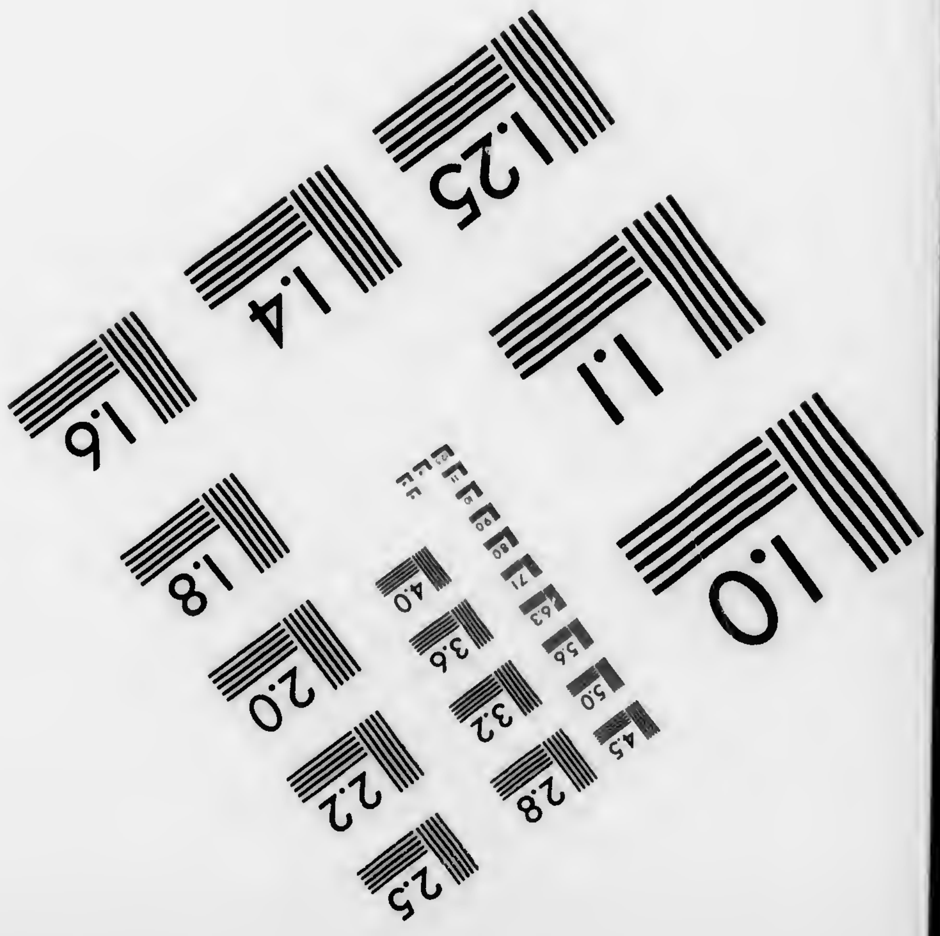

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THE PENNSYLVANIA STATE COLLEGE
THE GRADUATE SCHOOL

Department of Dairy Husbandry

FACTORS CONDUCIVE TO INCREASED YIELDS OF MILK AND BUTTERFAT IN PRIVATELY OWNED HOLSTEIN HERDS IN PENNSYLVANIA

A Thesis

By

Alexander Watson Williams

Submitted in partial fulfillment
of the requirements
for the degree of
MASTER OF SCIENCE

August, 1941

APPROVED:

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Head of Department of Dairy Husbandry

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TABLE OF CONTENTS

Page

Introduction 1

Review of Literature 2

Plan of Procedure 5

Herd Records 7

Type and Location of Farms 9

Housing Facilities 11

Personnel 24

Production Data .... 27 - 38

- Cow Population 27
- Total Milk Production 28
- Average Milk Production 31
- Rank of Herds 34
- Seasonal Production 37

Management Data .... 39 - 82

- Percentage of Cows Freshening Per Season 39
- Additions and Disposals 40
- Ages of Cows 42
- Milking Practices 43
- Feeding Practices 45
- Management of Dry Cows .... 51 - 65
  - Drying Off Procedures 51
  - Management of The Dry Cow 56
  - Management of Dry Cows at Calving Time 59
  - Dry Periods and Calving Intervals 64
- Management of Heifers .... 65 - 74
  - Winter 66
  - Summer 68
  - Preparation for Calving 70
  - Age of First Calving 73
- Management of Calves 74
- Management of Sires 80

Summary 83

Conclusion 89

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Page

Appendix 90

Bibliography 91

Acknowledgments 92

Owners and Addresses of Herds 93

INTRODUCTION

A previous study conducted by C. S. McLearen (9) showed a wide variation in the production levels and management methods of a group of purebred Holstein herds owned by State Institutions in Pennsylvania. The wide differences noted suggested the desirability of conducting a similar survey on privately owned purebred Holstein herds to determine the main differences in the management practices of such herds.

It is the intent of this study to bring out these differences, to determine if there are any practices common to high producing herds but lacking in the lower producing herds, and to see how the management practices and production of private herds compare with those of institutional herds.

REVIEW OF LITERATURE

The author has made no attempt to review the vast amount of literature pertaining to the various factors affecting milk production, but it is important that these factors be recognized before one can make a true comparison between cows or groups of cows. As pointed out by Yapp (16), the factors concerning the production level of any cow may be classified under two main divisions; (1) heredity, and (2) environment.

Billings (1) has emphasized the importance of intensity of milk production to the average dairy farmer where crop production is limited.

Literature dealing with management methods and production levels is very scarce, although there is an abundant amount of material concerning the various phases of management and their consequent effect upon milk production.

In 1938, McLearen (9) conducted a survey of fourteen State owned institutional Holstein herds in Pennsylvania. He discovered a wide variation in the management practices and production of these herds. Increased production was found to be a result of careful culling, shortening the length of calving interval, disease eradication, and good management practices.

The institutional herds studied ranged in size from 21 to 174 milking cows with an average of approximately 92 cows. These herds varied in average yearly production per cow from 10,980 pounds to 12,975 pounds of milk.

The most common method of milking was found to be by machine.

The average calving interval for the group was 12.4 months. The average age at first calving varied from 27 months to 32.9 months, but due to feeding conditions this difference was not thought to have any pronounced effect on milk production.

Production was found to be rather constant throughout the year, due to a uniform demand for fluid milk.

The three general methods of milking, as pointed out by Wayne et al (14), were used in drying up cows. Of the three methods (intermittant milking, incomplete milking, and complete cessation of milking), intermittant milking was employed in the largest number of cases.

There were three feeding methods employed in drying off cows in institutional herds. These were: (1) feeding only hay, (2) feeding small amounts of dry cow grain mix, hay and silage, and (3) feeding the same as in (2) but using a milking grain mix rather than the dry mixture.

The cows in institutional herds were given a six to eight weeks dry period, on the average.

The essential factors to successful calf raising were pointed out to be: (1) careful feeding, (2) strict sanitation, and (3) proper housing. As a rule, calves were fed whole milk after weaning. After a short period of whole milk feeding, calves in some herds were changed to skim milk while in other herds the amount of grain fed was increased.

Only a few differences were found in the feeding practices employed in institutional herds and these were not considered to have any material effect upon milk production.

Cowden and Fouse (2), in a survey of dairy farms in Pennsylvania, found November, December and January to be the months of lowest milk production, and the months of May, June and July to be the highest. They also show that herds of producer-distributors have the least seasonal variation in milk production.

PLAN OF PROCEDURE

The forms used in the previous study were modified to fit the conditions of this project.

Various herds were selected from a number of farms suggested by the Dairy Extension division of the College, by various county agents, and from herds listed in the Pennsylvania State Dairymen's Report.

In order that the material to be collected might be obtained from representative Holstein herds in the State, certain requirements were established and the herds were selected to fit these requirements. The requirements were: (1) the herds must contain a majority of purebred Holsteins; (2) they must have been entered in Dairy Herd Improvement Associations for the past five years; (3) they must contain at least ten or more cows; (4) and they must be located in different sections of the State.

After the selection of a number of herds, each owner's permission was obtained to include his herd in the study. Twenty-four herds were chosen.

Farm visits were arranged with the owners in advance. Approximately one-half of the farms were visited during October and November of 1939 and the remainder were visited in July of 1940. Two visits were made to the first half of the group and but one visit made to the last half.

The data collected were obtained by observation of the herds and buildings, by questioning the owners, and by examination of the Dairy Herd Improvement Association Herd Books.

All statistical data have been collected from the herd books representing a period of five years. Milk production and number of cows were taken from June 1936 to June 1940. It was deemed necessary, in order that these figures cover the same period of time for each herd to establish an arbitrary testing year. This year ended at the time of the survey. Milk production is expressed in actual pounds of milk and the number of cows in cow years.

Data on calving intervals, dry periods, ages of first calving, and additions and disposals were collected over a five year period according to the actual testing year.

Ages of cows in each herd were taken as their age at the time of their last calving.

Notes on feeding and general management of all stock have been secured.

No attempt has been made to study blood lines, pedigrees or breeding programs.

As a matter of convenience, the herds have been given numbers in the order in which they were visited. The owner and address of each herd will be found in the appendix.

HERD RECORDS

The records kept on private herds are not as thorough or complete as those kept on institutional herds. This difference is quite logical and expected since, as McLearen (9) states, institutions often employ men to keep more complete records than those kept by the Dairy Herd Improvement Association tester and this is not practical for the average dairy farmer.

All herds surveyed were entered in Dairy Herd Improvement Associations so that the records kept were quite uniform for the group. These records consisted of the Dairy Herd Improvement Association herd books, calf books, and life history sheets. Herd data were entered in the books by the tester each month. Some dairymen keep daily milk weights for each cow, but this practice is followed by the minority of breeders.

Records in most Dairy Herd Improvement Associations have not been kept complete until the past few years. This is especially true of the life history sheets. However, at present, an attempt is being made by the Extension division of the College to have these records completed and brought up-to-date.

The herd book contains some data on the herd and detailed information on each cow in the herd. It shows the monthly herd summary and feeding records for the herd and monthly milk production and feed consumption for each cow as well as the breeding record and information pertaining to the history of each individual. This latter detail is the purpose of the life history sheets on which are recorded the pedigree, dates of calving and progeny data, dates of breeding, and yearly production records of each individual animal.

The calf book contains records pertaining to the history of the calves including date of birth, parents, identification, breeding, and first calving.

These records are entered monthly by the tester and the books remain at the farm for use by the owner whenever desired.

TYPE AND LOCATION OF FARMS

These farms are all general farms with milk production being only one of several enterprises. Other sources of income are poultry, beef cattle, horses, hogs, vegetable crops and farm crops. Some of these farms lean more toward milk production than others. These are generally the farms with larger herds, many of which are produce-distributers.

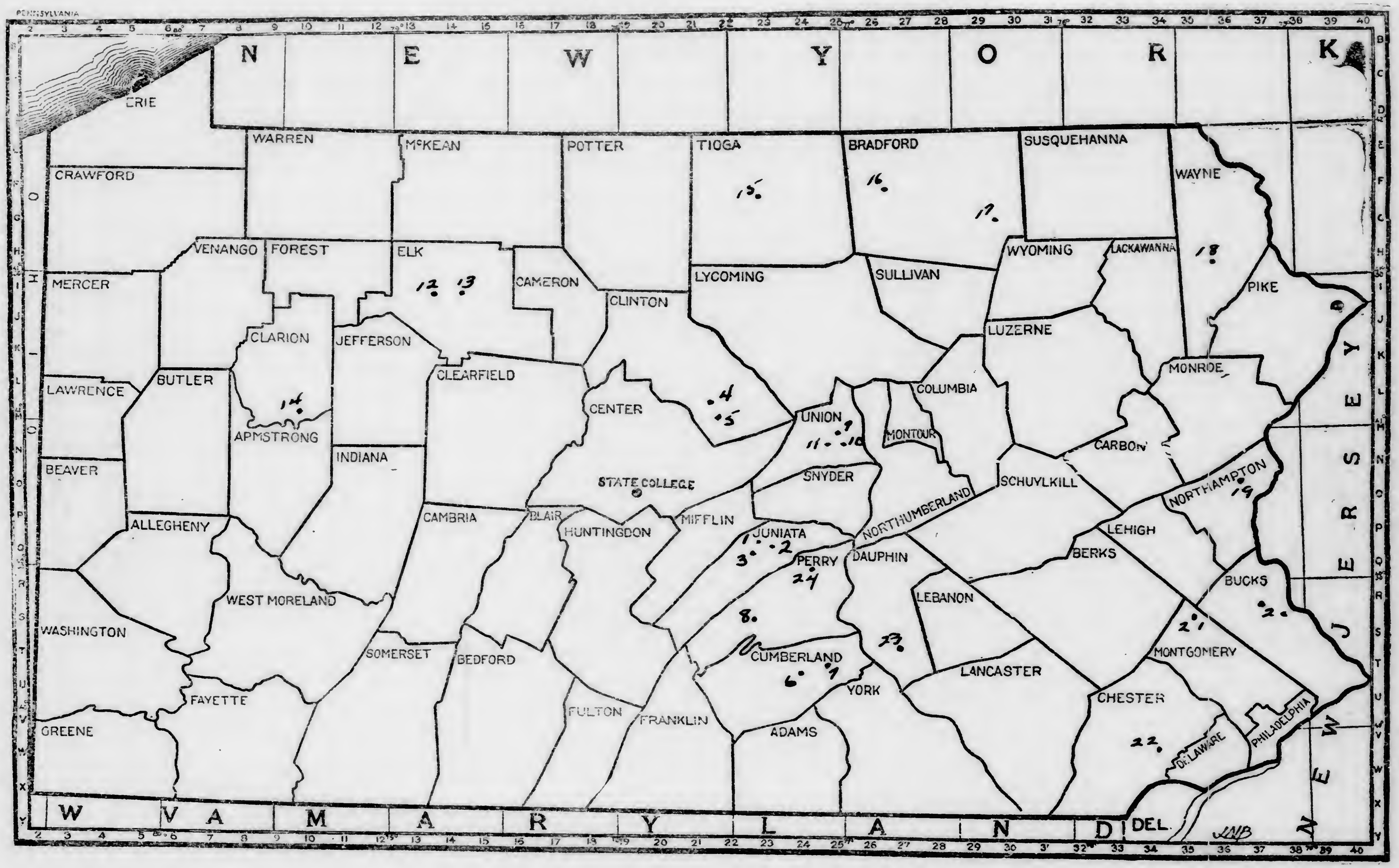
Of the group studied, five herds retail fluid milk to consumers of the community. The remaining nineteen herds sell fluid milk generally to local creameries although a few ship to large city creameries. The types of dairies are shown in Table I.

The farms are located in different sections of Pennsylvania (see map on page 10), with no more than three in the same section. The highest concentration of farms occurs in the central portion of the state. This selection of herds has made it possible to get representative herds from different farming sections and different milk sheds of the state.

Table I

Types of Dairies

Herd	Type	Herd	Type	Herd	Type
1	- Shipper	9	- Shipper	17	- Shipper
2	- Shipper	10	- Shipper	18	- Shipper
3	- Shipper	11	- Shipper	19	- Retailer
4	- Retailer	12	- Retailer	20	- Shipper
5	- Shipper	13	- Retailer	21	- Retailer
6	- Shipper	14	- Shipper	22	- Shipper
7	- Shipper	15	- Shipper	23	- Shipper
8	- Shipper	16	- Shipper	24	- Shipper



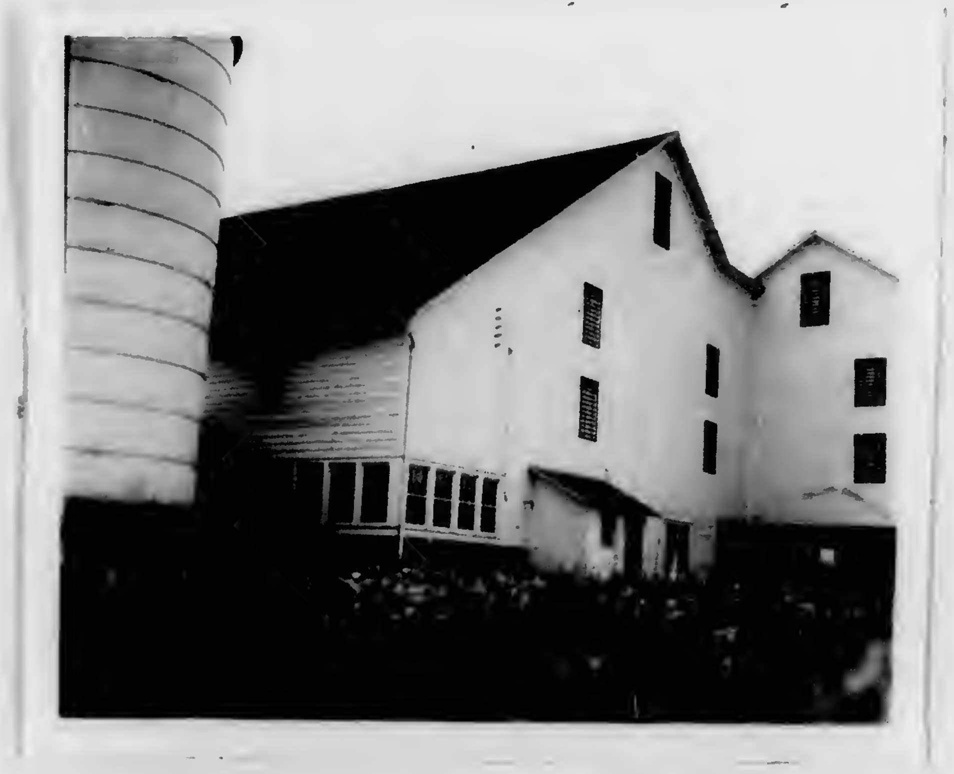
Location of Herds

HOUSING FACILITIES

The barns on these farms represent two general types of buildings. One is a specialized barn used only for dairy animals, and the other is a general purpose barn used for all stock. As described by Billings (1), the barns are generally of two stories and usually built on a slope with the upper floor overhanging the barnyard, furnishing a small amount of shelter. The basement walls are of masonry and the walls of the upper story may be also of masonry but more generally of frame construction. The animals are housed in the basement and hay and grain are stored on the upper floor.

Ventilation and lighting are often quite poor, although some barns are very good in this respect. Both stanchions and tie stalls are common, the stanchions being usually constructed of metal and the tie stalls of wood. Box stalls are most commonly made of wood although there are many made of metal pipes. All barns have concrete floors and straw is the most widely used type of bedding.

Below are exterior pictures of the barns on the farms covered in this survey.



Milking Barn of Herd 1

Barn I is the specialized type, housing only dairy stock. The horse barn is shown connected to the right rear corner. The cow stable is located by the large windows in the front and end.

Milking Barn of Herd 2

Barn 2 is the general purpose type, housing all kind of farm stock. The dairy stable is located in the left hand portion of the ground floor. Lighting and ventilation are quite poor here.

Milking Barn of Herd 3

Barn 3 is also the general purpose type. The milking stable is located in the center of the ground floor. Note again the poor lighting and ventilation of this type of barn.

Milking Barn of Herd 4

Barn 4 is a very excellent example of the specialized type of dairy barn. The milking barn is shown on the right.

Milking Barn of Herd 5

Barn 5 shown above, houses only milking cows. The bull is kept in the right end of the shed on the left. Heifers, calves and dry cows are kept in a separate barn.

Milking Barn of Herd 6

Barn 6 is shown above. Only dairy animals are kept in this barn.

Milking Barn of Herd 5

Barn 5 shown above, houses only milking cows. The bull is kept in the right end of the shed on the left. Heifers, calves and dry cows are kept in a separate barn.

Milking Barn of Herd 6

Barn 6 is shown above. Only dairy animals are kept in this barn.

INTENTIONAL SECOND EXPOSURE

Barn of Herd 7

This barn at herd 7 is used for all types of farm stock. The dairy stable occupies the entire ground floor with the exception of the right side which is the horse stable.

Barn of Herd 8

The location of the milking stable is shown by the row of windows on the left side. Horses are kept on the right side.

Barn at Herd 9

Barn 9 is of the general purpose type. This is a view of the rear side. Cows are housed in the basement.

Barn at Herd 10

Barn 12, above, is a general purpose barn. The milking stable is located in the right side of the picture. The horse stable is on the far end.

Barn at Herd 11

Barn 11, above, is of the specialized type. Only dairy animals are kept in this barn.

Barn at Herd 12

Barn 12 is of the general purpose type. The milking stable is located as shown by the windows on the left. The small shed to the right also houses milking cows.

Barn at Herd 13

The milking stable of herd 13 is shown above. Only dairy animals are housed in this barn.

Barn at Herd 14

Above is pictured the milking stable of herd 14. This barn houses only dairy stock.

Barn at Herd 15

This barn houses both dairy stock and horses. The bull is kept in the shed adjoining the right side of the barn.

Barn at Herd 16

This barn houses both horses and cows. The milking stable covers the entire ground floor with the exception of a portion of the front.

Barn at Herd 17

The milking stable occupies the ground floor of the larger structure. The rear building to the left houses the heifers and the building in the left foreground is the straw shed.

Barn at Herd 18

Only milking cows are housed in this barn. Other animals are kept in a barn separate from this.

Barn at Herd 19

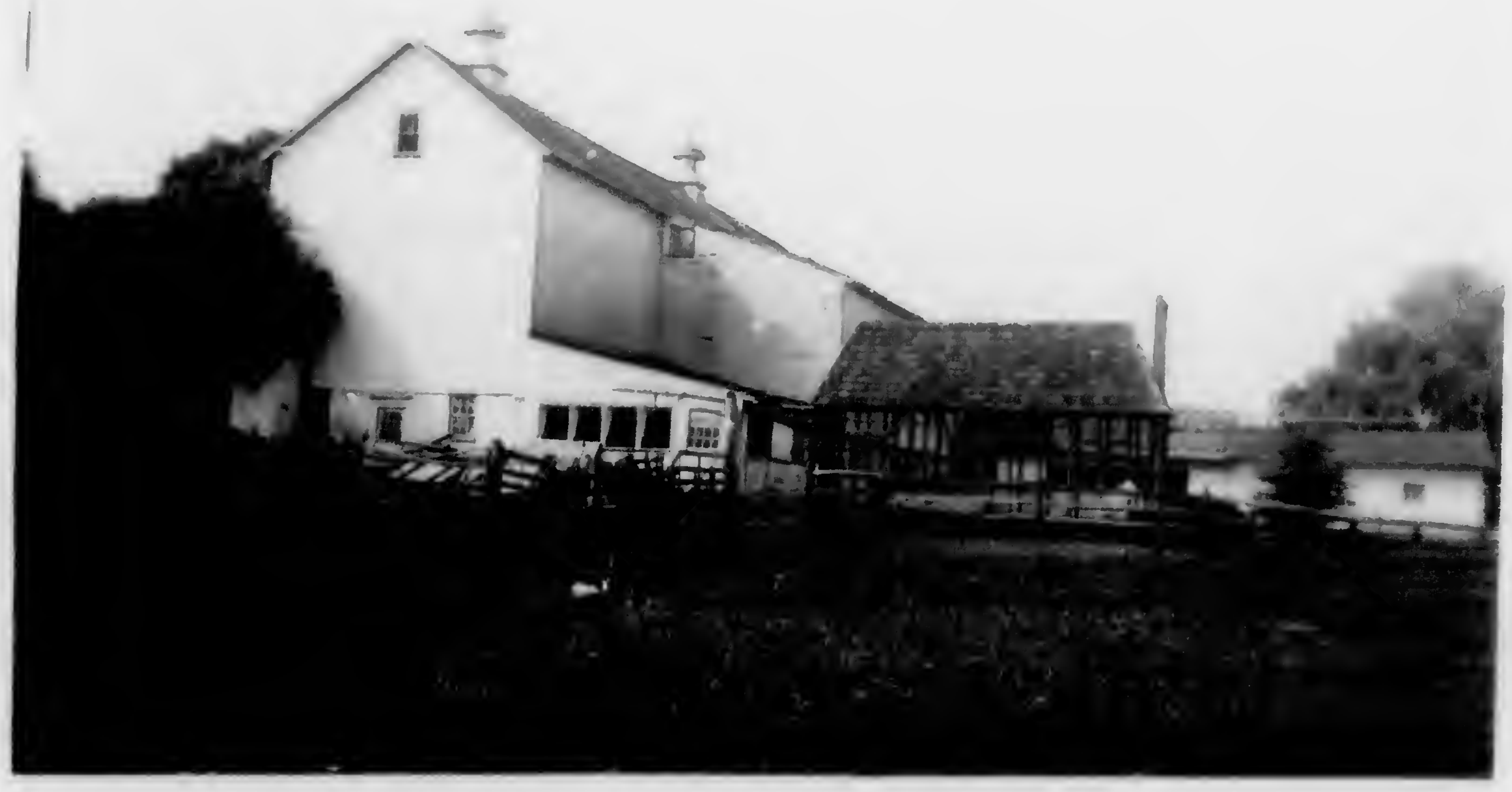
The milking stable is shown on the right. Heifers and horses are housed in the large barn on the left.

Barn at Herd 20

The milking stable is shown on the left. Other stock are kept in the large barn on the right.

Barn at Herd 21

The milking stable of this herd covers the entire ground floor of the barn shown above.



Barn at Herd 22

This is a general purpose barn. The horses are kept in the extreme left corner. The bull is housed in the small building on the extreme right.

Barn at Herd 23

This is a general purpose barn. The milking stable is on the right on the first floor.

Barn at Herd 24

The milking stable is in the center of this barn. The bull is kept in the right end and horses in the left end.

Lighting and ventilating conditions are quite poor in the barns of herds 2, 3, 10, 14, and 24. However these conditions are not likely to have a pronounced effect upon the milk production of these herds, although they may have a slight effect.

On the average, the housing conditions on private farms are inferior to those on institutional farms.

The most conveniently arranged barns of the group are found at herds 1, 4, 6, 8, 11, 13, 17, 19, 20, and 22. The remaining barns are only average in this respect.

PERSONNEL

The following table gives the age, education and amount of experience of each operator.

Table II

Data on Farm Operators

Herd	Age	Education	Experience
1	51	Grade School, High School 1 year Prep School, 1 year Normal School.	Raised on Farm. Farming all of life. Dairying since 1915.
2	63	Grade School.	Farming for 26 years.
3	48	Grade School.	Farming all of life. Dairying since 1930.
4	34	Grade School, short course in dairy farm management.	Farm manager for 7 years.
5	27	Three years High School, short course in dairy farming.	Raised on farm. Farming for 11 years.
6	55	High School.	Farming all of life.
7	46	High School, short course in dairy farming.	Raised on farm. Dairying since 1913.
9	38	High School.	Farming with father until 1937.
10	51	Grade School.	Farming for 20 years.
11	64	Grade School.	Dairying all of life. Once operated creamery.
12	45	Grade School.	Dairying all of life.
13	62	Grade School.	Dairying all of life.
14	55	Grade School, business training.	Working on farm for 30 years. De Laval dealer and feed dealer.

Table II
(Continued)

Herd	Age	Education	Experience
15	42	Grade School.	Farming all of life.
16	62	High School.	Farming for 40 years.
17	43	B.S. Degree in dairy production.	Taught school for 4½ years, managing farm for 3 years.
18	45	Grade School, two year course in dairy farming.	Milk tester for 2 years. Managed farm for 4 years, managing own farm for 18 years.
19	46	High School, Normal School.	Farming for 25 years.
20	57	Grade School.	Dairying for 34 years.
21	25	High School, short course in dairy farming.	Farming all of life. In charge of farm for 5 years.
22	47	Grade School.	Farming for 30 years, managing farm for 5 years.
23	47	High School, 2½ years of college.	Dairying for 17 years.
24	30	High School, two year course in dairy farming.	Dairying for 10 years.

With the exception of farms 4, 8, and 22, all the herds are managed by the owners. Herd 8 is managed jointly by the owner and son-in-law. Herd 4 is managed by a hired herdsman. Herd 22 is managed jointly by the owner and a manager.

Farm operators with special training in dairy production are in the minority. In the majority of cases, grade and high school education is the maximum scholastic training of the operators.

Farming experience varies greatly, as does the ages of the managers. It is interesting to note that the younger managers have all had special training in dairying.

PRODUCTION DATA

Cow Population

The herds included in this study range in average number of cows per year for the five year period from 12.25 cows to 33.34 cows with an average of 20.96 cows for the group.

The number of cows per herd for each year of the period is shown in Table III. There has been a gradual increase in average number of cows per herd during the period of the study. The increase has been from 20.10 cows per herd for 1935 to 22.63 cows per herd for 1939.

Individual herds exhibit quite a large variation in number of cows from year to year, some increasing and others decreasing; but with few exceptions, all herds have increased in size during the five year period.

Herds 12, 13 and 18 have had the largest numbers of cows for the period while herds 1, 3 and 11 have had the smallest numbers.

The majority of all cows are purebred Holsteins. Some herds have a small number of grade cows but these make up a very small portion of the total number of cows. Herd 12 has the largest percentage of grade animals. This is undoubtedly one of the factors which causes the low production in this herd.

Table III

Cow Population

Herd	Number of Cows Per Herd					
	1935	1936	1937	1938	1939	Average
1	13.22	12.12	12.12	13.54	13.18	12.84
2	14.25	14.00	13.82	15.61	14.63	14.46
3	12.10	12.29	12.42	11.62	12.81	12.25
4	23.91	23.89	26.05	31.82	33.56	27.85
5	12.03	14.79	15.51	19.95	18.93	16.24
6	21.44	14.39	21.38	22.96	23.93	20.82
7	29.46	32.18	30.06	31.66	29.38	30.55
8	12.88	13.59	16.11	19.41	19.35	16.27
9	26.87	19.81	13.55	14.79	14.64	17.93
10	17.77	15.60	17.94	15.60	15.87	16.56
11	12.03	12.43	12.97	10.91	12.99	12.27
12	34.89	30.98	33.31	32.46	27.34	31.80
13	30.13	26.96	32.43	33.25	35.22	31.60
14	28.04	27.90	23.53	24.32	29.29	26.62
15	13.25	14.17	15.06	17.29	19.62	15.88
16	19.52	24.60	22.08	25.36	25.48	23.55
17	25.19	20.77	21.62	21.49	22.23	22.26
18	28.78	32.74	33.70	33.07	38.42	33.34
19	19.39	15.87	20.42	22.44	24.54	20.53
20	19.16	18.07	20.32	22.84	23.49	20.78
21	19.43	19.84	22.51	26.45	27.98	23.20
22	21.47	24.14	22.22	23.92	26.93	23.74
23	10.72	12.20	16.47	19.84	18.02	15.45
24	16.52	17.25	16.62	15.54	15.22	16.21
Average All Herds	20.10	19.61	20.54	21.92	22.63	20.96

Total Milk Production

Table IV shows that the average total yearly production of this group of herds has been increasing each year from 1935 to 1939. The total increase in pounds of milk has been from 203,386 in 1937 to 231,103 in 1939.

All herds have not been increasing at the same rate and some have even shown a decrease. Herds 4, 7 and 18 have shown the highest average total yearly milk production for the five years, while herds 3 and 11 have shown the lowest production.

Herds 1, 14 and 24 have shown a decrease in production. Herds 8, 9, 11, 17 and 19 showed a decrease from 1935 to 1937, but have, since then, shown an increase in production.

Table IV

Total Milk Production Per Herd Per Year

Herd	1935	1936	1937	1938	1939	Average
1	176,430	150,311	141,510	161,295	137,948	153,499
2	153,943	168,413	154,140	163,139	169,961	161,919
3	124,683	138,890	113,607	134,381	129,628	128,238
4	251,177	232,868	281,006	345,000	348,023	291,615
5	120,186	176,601	185,229	206,797	234,642	184,691
6	238,038	191,522	236,218	259,945	267,746	238,694
7	283,430	336,551	334,241	338,211	359,350	330,356
8	158,564	147,195	148,927	206,754	223,778	177,044
9	311,717	236,226	143,946	161,156	161,991	203,007
10	149,207	171,993	149,277	151,169	166,440	157,617
11	133,591	138,474	120,440	115,841	152,139	132,097
12	235,236	234,421	277,754	245,821	253,588	249,364
13	253,614	261,211	274,338	299,587	316,310	281,012
14	288,695	276,505	241,354	266,849	258,375	266,356
15	176,240	188,451	196,776	218,074	206,138	197,136
16	227,398	231,840	254,782	251,063	256,496	234,316
17	234,908	218,642	203,573	221,529	224,863	220,703
18	298,858	331,391	284,042	301,633	335,763	310,338
19	206,478	196,319	181,315	209,045	216,208	201,873
20	166,670	192,681	178,528	199,704	238,544	195,225
21	188,514	222,279	244,861	278,114	272,634	241,280
22	234,426	240,815	241,940	245,619	305,342	253,628
23	111,490	124,587	177,418	178,762	196,282	157,708
24	190,557	154,244	136,040	144,501	114,286	147,926
Average All Herds	204,752	206,768	203,386	220,166	231,103	213,235

It is interesting to note the relation of total production to the size of the herd. As shown in Table V and in Figure I, it is the general trend for total milk production to increase with increase in number of cows. This conforms to expectation and the amount of increase in production is dependant on the quality of the cows added.

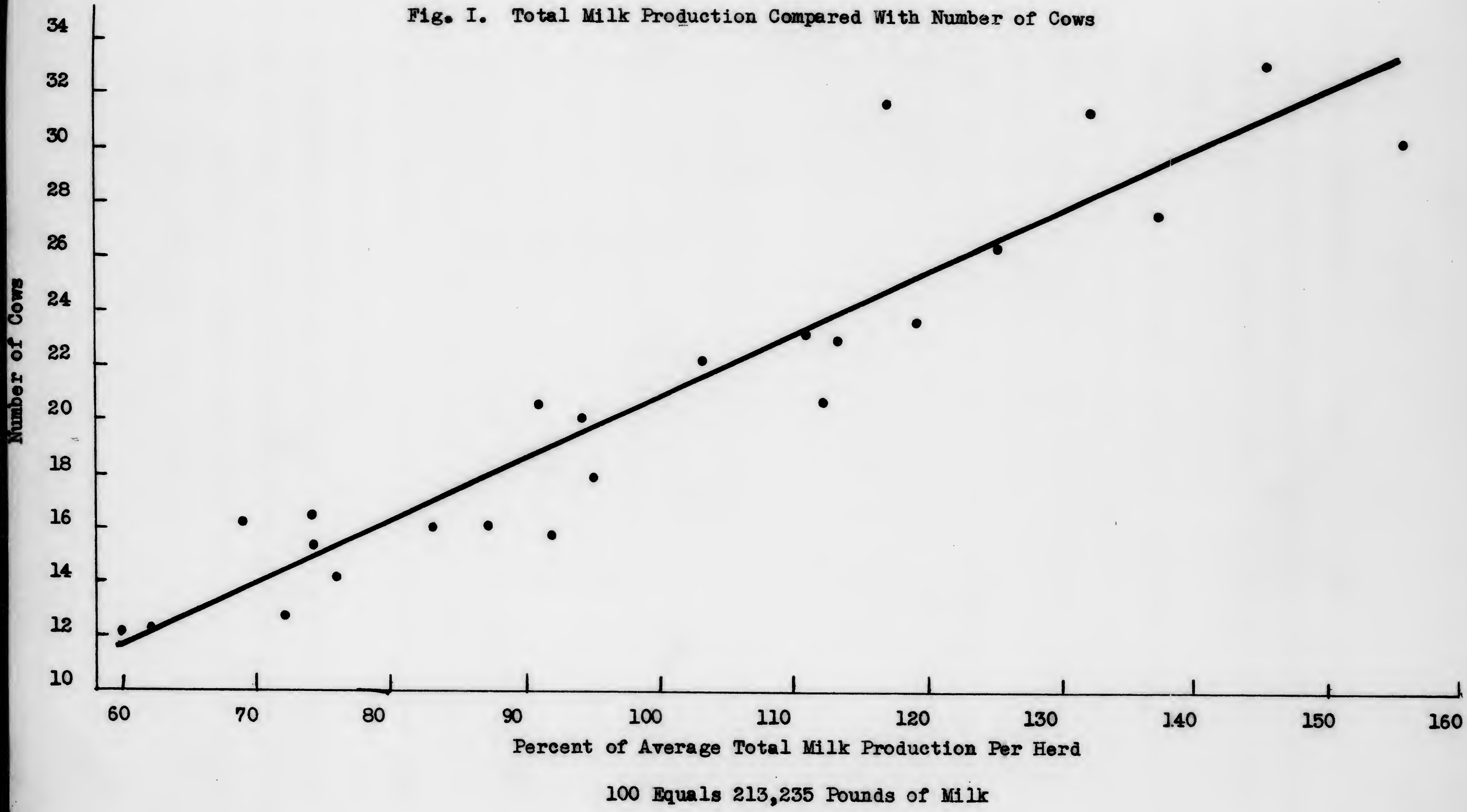
Table V

Number of Cows Compared With Total Production of Milk

Herd	Number of Cows	Total Milk Production	Index of Total Production*
18	33.44	310,358	145
12	31.80	249,364	117
13	31.60	281,012	132
7	30.55	330,356	155
4	27.85	291,615	137
14	26.62	266,356	125
22	23.74	253,628	119
16	23.55	236,316	111
21	23.20	241,280	113
17	22.26	220,703	103
6	20.82	238,694	112
20	20.78	195,225	91
19	20.53	201,873	94
9	17.93	203,007	95
10	16.56	157,617	74
8	16.27	177,044	83
5	16.24	184,691	87
24	16.21	147,926	69
15	15.88	197,136	92
23	15.45	157,708	74
2	14.46	161,919	76
1	12.84	153,499	72
11	12.27	132,097	62
3	12.25	128,238	60
Average	20.96	213,235	100

*Percent of Average Production for All Herds.

Fig. I. Total Milk Production Compared With Number of Cows



Average Milk Production

As shown in Table VI, the average yearly milk production per cow has remained more or less stable in these herds during the period of this study.

The herds range in average production from 7,899 pounds of milk per cow per year for herd 12 to 12,557 pounds of milk per cow for herd 15. The average production for all herds was 10,380 pounds of milk per cow per year for the five year period.

The decrease in number of cows per herd in 1936 as shown in Table III was accompanied by a decided increase in average production per cow for that year. This is a good example of the merits of culling, expressed in a general decrease in number of cows in the lower producing herds.

With an increase in number of cows per herd in 1937 the average production per cow decreased and there resulted a decrease in total production per herd for that year, as shown in Table IV. Since 1937 the number of cows, average production per cow, and total production per herd have been increasing slowly but gradually.

Herds 10, 12, 13, 18 and 24 have been the consistently low herds of this group, while herds 1 and 15 have been consistently high in average yearly milk production per cow. Variations in ranking are very marked among the other herds of this group.

In agreement with Johnson and McCord (7), it appears that as the size of the herd increases, the average yearly milk production per cow decreases. Table VII and accompanying graph show that lowest average production is generally associated with herds larger than average, and that highest average production is associated with herds smaller than average.

Table VI

Average Milk Production Per Cow

Herd	Average Yearly Milk Production Per Cow					
	1935	1936	1937	1938	1939	Average
1	13,345	12,402	11,676	11,912	10,466	11,960
2	10,803	12,029	11,153	10,451	11,617	11,210
3	10,304	11,301	9,147	11,565	10,119	10,487
4	10,505	9,747	10,787	10,842	10,370	10,450
5	9,990	11,940	11,942	10,366	12,395	11,326
6	11,102	13,309	11,048	11,322	11,189	11,594
7	9,621	10,458	11,119	10,682	12,231	10,822
8	12,311	10,831	9,244	10,652	11,565	10,921
9	11,601	11,925	10,623	10,896	11,065	11,222
10	8,397	11,025	8,321	9,690	10,488	9,584
11	11,105	11,140	9,286	10,618	11,712	10,772
12	6,742	7,567	8,338	7,573	9,275	7,899
13	8,417	9,689	8,459	9,010	8,981	8,911
14	10,296	9,911	10,257	10,972	8,821	10,051
15	13,301	13,299	13,066	12,613	10,506	12,557
16	11,649	9,424	10,297	9,111	10,067	10,109
17	9,325	10,527	9,416	10,308	10,115	9,938
18	10,384	10,122	8,429	9,121	8,739	9,359
19	10,649	12,370	8,879	9,316	8,810	10,005
20	8,699	10,663	8,786	8,744	10,155	9,409
21	9,702	11,203	10,849	10,515	9,744	10,402
22	10,919	9,956	10,888	10,763	11,338	10,773
23	10,400	10,212	10,772	9,010	10,892	10,257
24	11,549	8,942	8,185	9,297	7,509	9,096
Average All Herds	10,463	10,833	10,040	10,225	10,340	10,380

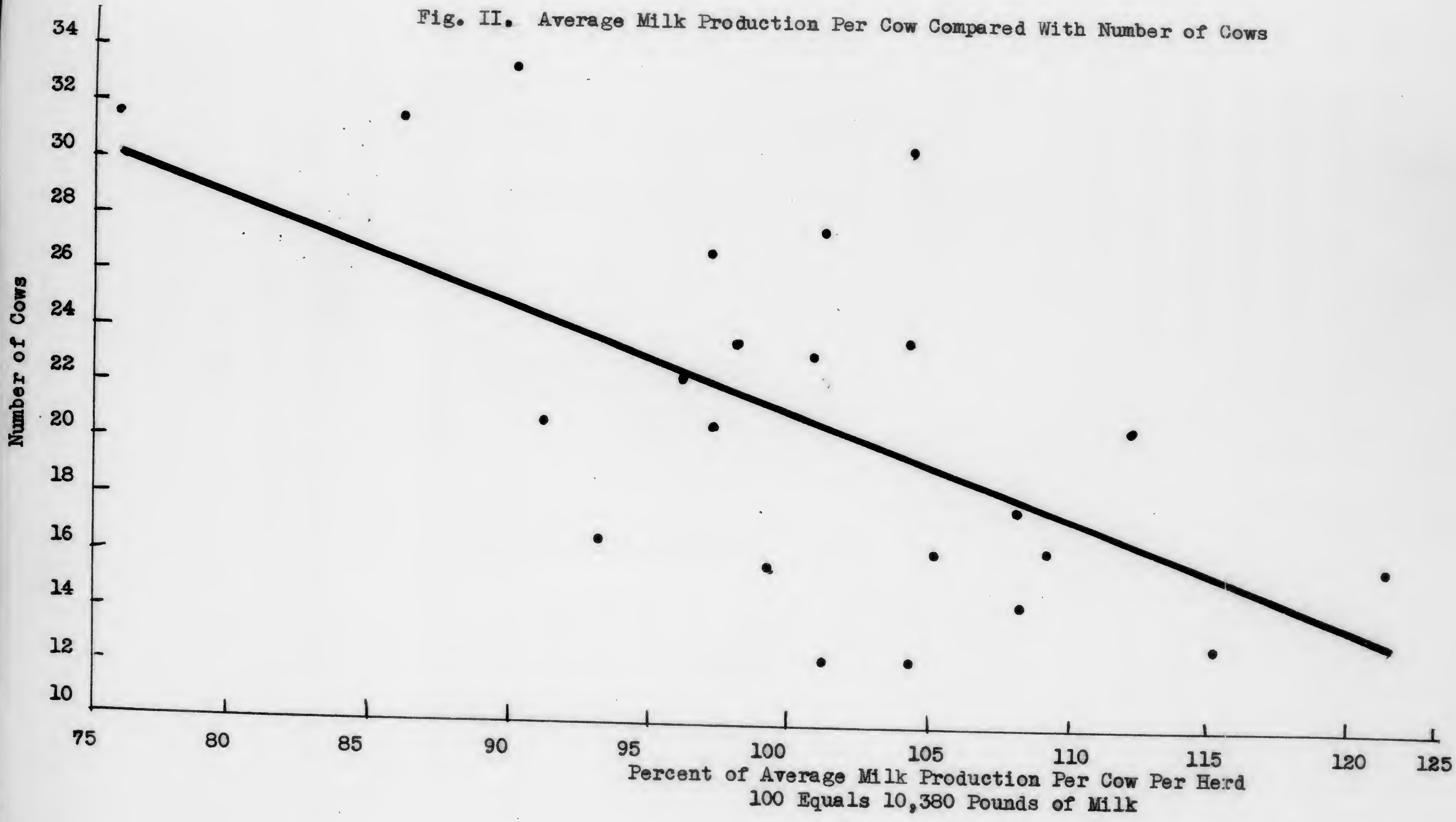
Table VII

Number of Cows Compared with Average Production Per Cow

Herd	Number Cows	Average Production Per Cow	Index of Average Production Per Cow*
18	33.44	9,359	90
12	31.80	7,899	76
13	31.60	8,911	86
7	30.55	10,822	104
4	27.85	10,450	101
14	26.62	10,051	97
22	23.74	10,773	104
16	23.55	10,109	98
21	23.20	10,402	101
17	22.26	9,938	96
6	20.82	11,594	112
20	20.78	9,409	91
19	20.53	10,005	97
9	17.93	11,222	108
10	16.56	9,584	93
8	16.27	10,921	105
5	16.24	11,326	109
24	16.21	9,096	88
15	15.88	12,577	121
23	15.45	10,257	99
2	14.46	11,210	108
1	12.84	11,960	115
11	12.27	10,772	104
3	12.25	10,487	101
Average	20.96	10,380	100

*Percent of Average Production Per Cow For All Herds.

Fig. II. Average Milk Production Per Cow Compared With Number of Cows



Rank of Herds

Table VIII shows the rank of the herds of this group in respect to the average yearly milk production per cow.

The average production per cow for the group as shown in Table VI is 10,380 pounds of milk. All herds of the institutions studied by McLearen (9) are above the average as compared with private herds. The average production of the Institutional herds ranged from 10,980 pounds of milk to 15,332 pounds of milk.

Table VIII

Average Yearly Milk Production Per Cow

Rank	Herd	Index*	Rank	Herd	Index*
1	15	121	13	21	101
2	1	115	14	23	99
3	6	112	15	16	98
4	5	109	16	14	97
5	9	108	17	19	97
6	2	108	18	17	96
7	8	105	19	10	95
8	7	104	20	20	91
9	22	104	21	18	90
10	11	104	22	24	88
11	3	101	23	13	86
12	4	101	24	12	76

*For Actual Production, See Table VII.

Seasonal Production

The largest percentage of the total milk produced in these herds is produced during the spring months. The smallest percentage is produced during the fall months. This is in agreement with the results of Cowden and Fouse (2) in their study of the supply and utilization of milk in Pennsylvania.

Table IX shows the percentage of the total yearly milk production for each season. There is a great deal of variation in milk production between the herds of the group in this respect.

In herd 15, which ranks first in production per cow, most of the milk is produced during the winter and spring months. Herd 1, ranking second, shows the greatest production during the spring and summer months.

Herds 4, 12, 13, 19 and 21 are producer-distributor herds and their production is quite uniform throughout the year with highest production being in spring and summer.

Figure III shows the monthly production curve for this group of herds. In agreement with a study conducted on 8,000 farms in Minnesota (11), the lowest production occurs during the fall months, at which time the number of cows milking is also lowest. There is a fast upward trend in both number of cows milking and total production from November to January and a slower increase from January to May. Highest production and the highest number of cows milking occur in May when the pastures are at their best. There is a rapid decline in milk production during the summer months. During this period also, the number of cows milking is greatly reduced.

Figure IV shows the monthly production curve for herd 4, a typical producer-distributor herd. Note the evenness of the curve throughout the year as compared with that of the whole group.

Table IX

Seasonal Production for Five Years (1935-1939)

Herd	Percent Total Milk Produced Per Season*			
	Summer	Fall	Winter	Spring
1	27.6	23.6	21.6	27.2
2	23.1	18.2	28.1	30.6
3	25.7	19.3	21.7	33.3
4#	25.8	24.5	24.4	25.3
5	24.3	25.0	25.3	25.4
6	26.3	24.7	25.0	24.0
7	24.4	22.5	24.9	28.2
8	26.0	19.1	27.8	27.1
9	20.7	20.0	30.5	28.8
10	25.4	21.9	24.8	27.9
11	25.1	23.5	21.7	29.7
12#	27.2	23.4	23.0	26.4
13#	24.4	24.6	24.1	26.9
14	24.2	24.3	24.7	26.8
15	22.7	18.8	27.2	31.3
16	29.3	16.6	23.6	30.5
17	17.8	22.6	32.1	27.5
18	16.4	23.3	32.4	27.9
19#	27.2	23.2	22.5	27.1
20	26.3	22.6	23.5	27.6
21#	24.9	21.2	25.6	28.3
22	24.9	23.3	24.7	27.1
23	18.5	19.7	28.9	32.9
24	30.0	21.3	20.6	28.1
Average All Herds	25.4	22.0	26.1	28.2

*Summer: June, July, August.
Fall: September, October, November.
Winter: December, January, February.
Spring: March, April, May.

#Producer-Distributor Herds.

Fig. III. Monthly Production and Total Cows Milking Per Month for All Herds.

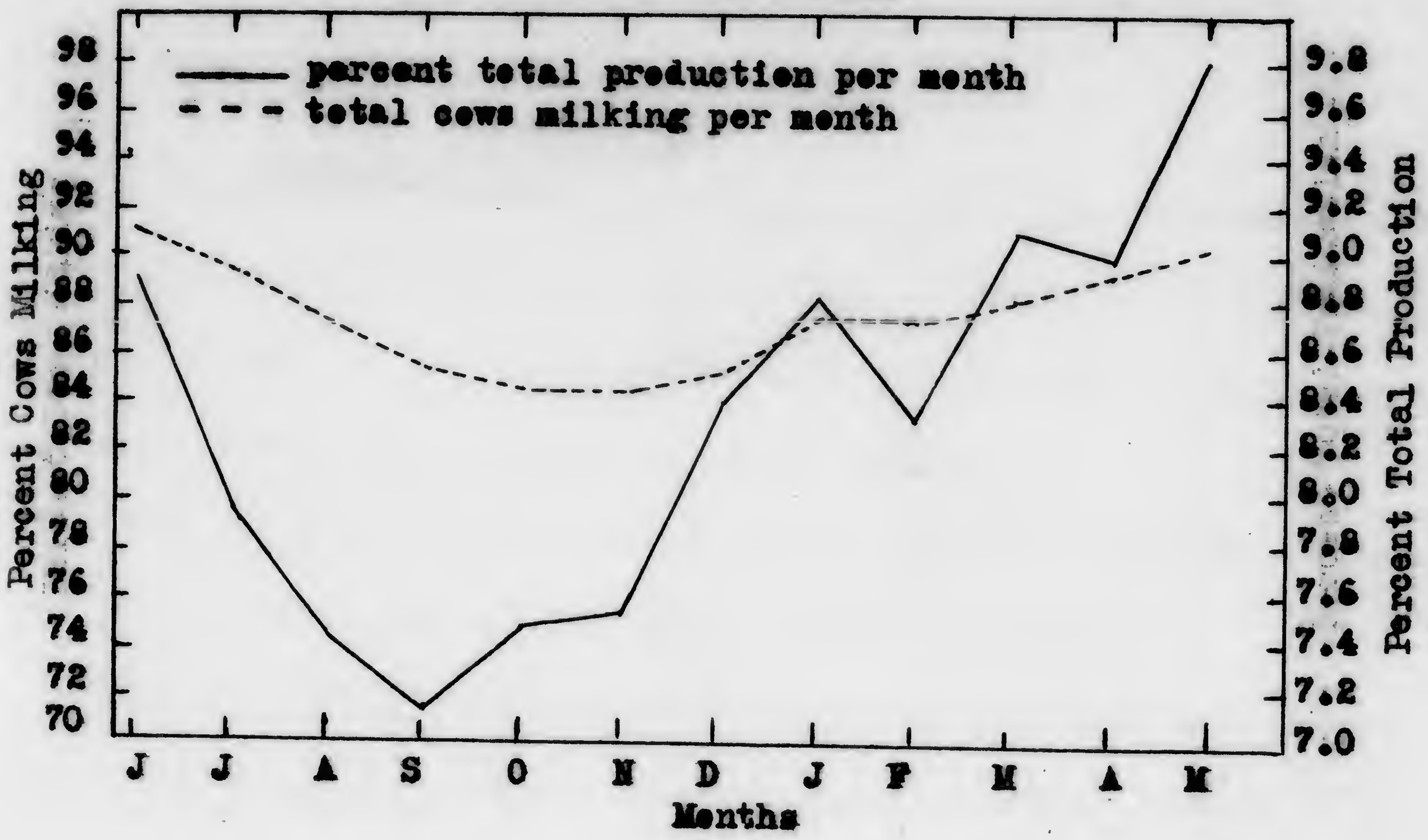
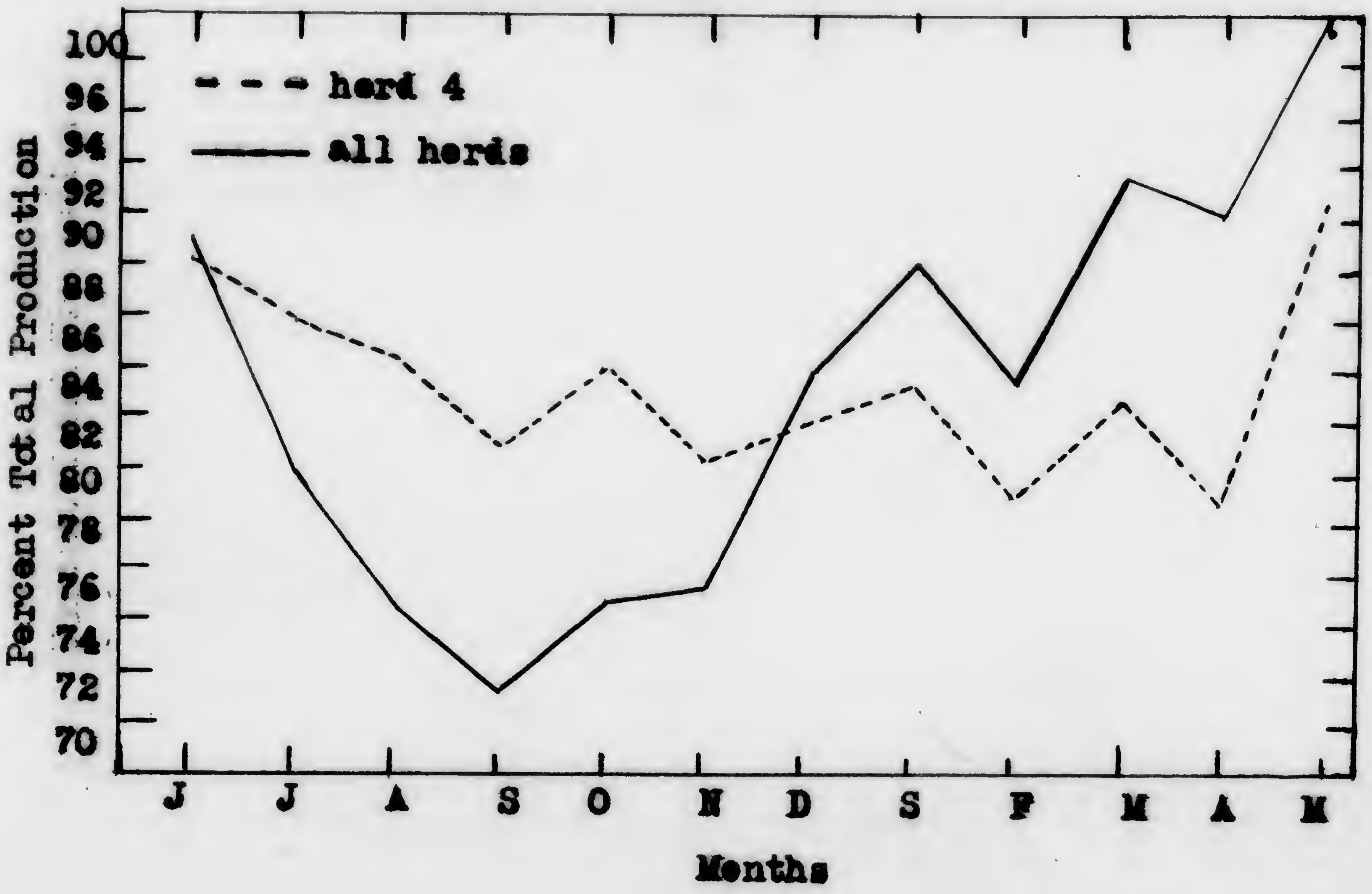


Fig. IV. Monthly Production of Herd 4 as Compared with All Herds.



MANAGEMENT DATA

Percentage of Cows Freshening by Seasons

In Table X is shown the percentage of cows freshening each season in the various herds. Eckles (4) and Espe (5) conclude that cows calving in the fall or winter months will produce more milk yearly than cows freshening in spring or summer months.

In this group of herds, there appears to be no relation between the time of freshening and the level of milk production.

Herd 15, ranking first in production, has seventy-eight percent of its cows freshening in the fall and winter months. Herd 1, which ranks second in production, has only forty-eight per cent freshening during these months. Herd 17, ranking eighteenth in production, has eighty-eight per cent of its cows freshening in the fall and winter months. Herd 18, ranking twenty-first, has seventy per cent freshening in fall and winter.

Differences in production levels of these herds cannot be explained on the basis of seasonal freshening. Although the average of all herds shows the largest percentage of cows freshening in the fall and winter months, variation in this respect is quite pronounced.

Table X

Per Cent of Cows Freshening by Seasons

Herd	Summer	Fall	Winter	Spring
1	30.4	16.1	32.1	21.4
2	21.6	18.0	38.2	22.2
3	19.2	15.1	47.9	17.8
4	27.8	19.6	18.8	33.8
5	37.3	18.1	22.9	21.7
6	22.9	38.5	10.7	27.9
7	21.6	30.4	28.8	19.2
8	13.5	34.4	35.4	16.7
9	21.5	46.2	26.9	5.4
10	20.0	30.0	26.0	24.0
11	23.4	12.5	26.6	37.5
12	24.6	19.2	19.2	37.0
13	26.7	21.3	18.7	33.3
14	34.6	23.8	14.7	26.9
15	4.1	43.3	35.1	17.5
16	0.1	25.6	42.2	31.1
17	7.6	73.7	14.4	4.3
18	21.5	49.7	20.9	7.9
19	22.2	14.8	37.0	26.0
20	18.4	23.3	15.0	43.3
21	21.6	27.0	31.8	19.7
22	26.2	26.2	25.5	22.0
23	11.3	43.0	31.7	14.0
24	17.5	16.5	28.5	27.5
Average All Herds	20.7	28.6	27.1	23.3

Additions and Disposals

There was an average of 6 animals added to the herds yearly and an average of 5 animals sold, showing an average increase of one cow per herd per year for the five-year period.

As shown by Table XI, there are very few cows purchased for additions to the herd. Most all additions consist of heifers raised on the farms.

The majority of disposals consist of animals sold for dairy purposes, animals discarded due to Bang's disease, and animals removed due to low production. More than three-fourths of the animals disposed of are sold for dairy purposes. Removals due to Bang's disease rank second. Diseases other than Bang's do not cause a great deal of trouble. Mastitis is at a minimum in these herds.

Table XI shows the number of cows and heifers added to each herd for each year of the five year period.

Table XI

Yearly Addition of Cows To Herds

	Number of Cows and Heifers Added to Herds					
Herd	1935	1936	1937	1938	1939	Average
1	3	1 ± 2*	2	4	2	3
2	1	3	6	4	5	4
3	0	2	3	6	3	3
4	9	6	10	13	16	11
5	2	6	11	0	9	6
6	0	8	10	5	10	6
7	10	10 ± 2	10	4	10	9
8	7	1 ± 1	12	5	8	7
9	6	13 ± 2	3	4	3	6
10	3	3	4	3	7	4
11	4	3	2	2	3	3
12	5	5 ± 1	15	5	5	7
13	5	6	8	6	9	7
14	7	3	4	8	9	6
15	-	3	2	7	0	3
16	9	2	3	5	4	5
17	4	6	3	4	11	6
18	7	9	7 ± 1	7	13	9
20	2	6	6	5	4	5
21	11	5	7	6	4	7
22	4	10	9	6	15	9
23	4	4	9	4	7	6
24	6	3	2	5	2	4
Average All Herds	5	6	6	5	7	6

*First Number Heifers
Second Number Cows

Table XII shows the number of animals disposed of in each herd for each year of the period.

Table XII

Annual Disposal of Cows From Herds

Herd	Number of Cows Sold From Herds					
	1935	1936	1937	1938	1939	Average
1	4	7	4	5	5	5
2	4	5	2	7	1	4
3	1	1	2	1	3	2
4	4	7	9	7	12	8
5	3	7	5	3	8	5
6	7	3	1	9	6	5
7	5	24	8	12	8	11
8	3	2	5	3	15	6
9	7	25	1	3	1	7
10	5	5	5	4	6	5
11	2	2	4	0	5	3
12	10	8	7	8	5	8
13	8	6	4	6	8	6
14	7	11	5	8	4	7
15	-	3	4	5	3	4
16	3	5	4	3	6	4
17	12	2	4	7	6	6
18	2	6	9	4	9	6
20	2	5	2	2	3	3
21	8	4	1	5	7	5
22	6	5	10	3	9	6
23	1	3	0	11	1	3
24	6	3	4	2	6	5
Average All Herds	5	6	4	5	6	5

Age of Cows

The average age of the cows in each herd of this group at the time of their last calving is shown in Table XIII. Herd 15, which leads the group in average production per cow, has a larger percentage of old cows than any other herd. Herd 1, which ranks second in production per cow, is composed of a larger number of younger cows than any other herd of the group.

The average age of the cows in all herds is 4 years and 11 months.

Table XIII

Herd	Age of Cows	
	Years	Months
1	3	6
2	4	3
3	5	0
4	4	2
5	4	10
6	5	1
7	5	11
8	4	4
9	3	11
10	4	4
11	5	0
12	4	10
13	5	0
14	4	6
15	7	0
16	5	0
17	3	9
18	5	0
19	6	6
20	6	3
21	6	0
22	4	9
23	4	4
24	4	5
Average	4	11

Due to the large amount of variation in the ages of the cows in the different herds, age does not seem to be a factor which causes the differences in production between these herds.

Milking Practices

All herds in this group are milked two times daily, the general hours of milking being at 5 A.M. and 5 P.M. There are three herds, 19, 20 and 23, which are milked at 6 A.M. and 6 P.M. Herd 4 is milked at 6:30 A.M. and 4:30 P.M.; herd 1 is milked at 6 A.M. and 5 P.M.; and herd 2 is milked at 4:30 A.M. and 4:30 P.M. The longest and shortest intervals between milkings, fourteen and ten hours respectively, are in herd 4, the majority of herds being milked every twelve hours.

The majority of the herds are milked by machine, only five of the twenty-four being milked by hand. In these herds, two to three men do all the milking, the lesser number of men in the smaller herds. In those milked by hand, the number of cows per man varies from four to seven cows, with the exception of herd 23 where each man milks two to three cows.

Although work done by Mathews (8) and Dahlberg (3) shows no significant difference between hand and machine milking, hand milking is more popular in the herds of above average production. It is interesting to note that all the herds in the lower level of production are milked by machine.

Daily weights on the individual cows are recorded in only eight of the twenty-four herd. The general practice is not to keep daily production records.

Table XIV shows the number of milkings daily in each herd, the hours of milking, the method used, the number of men milking, the number of cows in the herd, and the herds which keep daily milk weights on each cow.

Table XIV

Milking Practices

Herd	Milkings Daily Number	Milking Hours	Milking Method	Men Milking Number	Number of Cows	Milk Weighed ± Yes - No
15	2	5:00 A.M.-5:00 P.M.	Machine	3	15.9	±
1	2	6:00 A.M.-5:00 P.M.	Machine	3	12.8	-
6	2	5:00 A.M.-5:00 P.M.	Hand	4	20.8	-
5	2	5:00 A.M.-5:00 P.M.	Machine	1	16.2	-
9	2	5:00 A.M.-5:00 P.M.	Machine	2	17.9	-
2	2	4:30 A.M.-4:30 P.M.	Hand	2	14.5	-
8	2	5:00 A.M.-4:40 P.M.	Machine	2	16.3	-
7	2	5:00 A.M.-5:00 P.M.	Hand	5	30.5	-
22	2	5:00 A.M.-4:00 P.M.	Machine	3	23.7	-
11	2	5:45 A.M.-5:00 P.M.	Machine	1	12.3	±
3	2	5:30 A.M.-5:30 P.M.	Hand	3	12.3	-
4	2	6:30 A.M.-4:30 P.M.	Machine	2	27.8	±
21	2	5:00 A.M.-5:00 P.M.	Machine	4	23.2	±
23	2	6:00 A.M.-6:00 P.M.	Hand	7	15.4	±
16	2	5:30 A.M.-5:30 P.M.	Machine	3	23.6	-
14	2	5:30 A.M.-5:30 P.M.	Machine	2	26.6	±
19	2	6:00 A.M.-6:00 P.M.	Machine	3	20.5	-
17	2	5:00 A.M.-5:00 P.M.	Machine	2	22.3	-
10	2	5:30 A.M.-5:30 P.M.	Machine	2	16.6	-
20	2	6:00 A.M.-6:00 P.M.	Machine	2	20.8	±
18	2	5:30 A.M.-5:30 P.M.	Machine	3	33.3	-
24	2	5:00 A.M.-5:00 P.M.	Machine	1	16.2	-
13	2	5:45 A.M.-5:30 P.M.	Machine	2	31.6	-
12	2	5:30 A.M.-5:30 P.M.	Machine	2	31.8	±

Feeding Practices

The feeding practices employed in the various herds are shown in Tables XV, XVI, and XVII.

Table XV shows the variation in the grain mixtures fed to the dairy cattle in the different herds. All herds do not have separate grain mixtures for milking and dry cows. In some cases the milking grain mixture is fed to all animals.

All herds except herd 9 feed grain to the sire.

Corn silage, alfalfa hay, and mixed hay comprise the roughage fed in most of the herds. Grass silage is fed in only a few herds. Silage is not usually fed in summer except when pastures are poor.

In herds 8, 9, 10, 11, and 19, where there is little or no pasture, hay and silage are fed all year. In some herds the cows may be allowed to graze the hay and wheat aftermath.

Only a few herds feed soiling crops in summer.

Table XV

Grain Feeding

Herd	Milking Cows	Dry Cows	Sire	Heifers	Calves
15	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Calf mix for 3 months.
1	Milk Mix	Milk Mix and bran	Milk Mix	Milk Mix	Calf mix for 4 months.
6	Milk Mix	Milk Mix	Milk Mix	Milk Mix	Calf mix until pasture.
5	Milk Mix	Dry Mix	Milk Mix	Dry Mix	Calf mix for 3 months.
9	Milk Mix	Dry Mix	No grain	Dry Mix	Calf mix for 6 months.
2	Milk Mix	Dry Mix	Kept at Herd 1	Dry Mix	Calf mix until pasture.
8	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Dry Mix
7	Milk Mix	Dry Mix	Milk Mix	Milk Mix	Calf mix for 3 months.
22	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Dry Mix

Table XV
(Continued)

Herd	Milking Cows	Dry Cows	Sire	Heifers	Calves
11	Milk Mix	Dry Mix	Milk Mix	Milk Mix	Dry mix until pasture.
3	Milk Mix	Milk Mix	Oats	Oats and bran	Oats and bran
4	Milk Mix	Milk Mix	Milk Mix	Milk Mix	Calf mix until pasture.
21	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Dry Mix
23	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Calf mix until pasture.
16	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Calf mix until pasture.
14	Milk Mix	Dry Mix	Milk Mix	Dry Mix	Calf mix for 6 months.
19	Milk Mix	Oats and bran	Calf Mix	Calf Mix	Calf mix and whole oats.
17	Milk Mix	Milk Mix	Milk Mix	Dry Mix	Dry Mix
10	Milk Mix	Dry Mix	Milk Mix	Dry Mix	Dry Mix
20	Milk Mix to all Stock				
18	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Dry mix and oats.
24	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Calf mix for 4 months.
13	Milk Mix	Dry Mix	Dry Mix	Calf Mix	Calf Mix
12	Milk Mix	Dry Mix	Dry Mix	Dry Mix	Dry Mix

Table XVI shows the roughages fed in the different herds.

Table XVI

Roughage Feeding

Herd

15. Corn silage fed in winter and fall. Hay fed in winter.

Table XVI
(Continued)

Herd

1. Corn silage fed during winter only. Hay fed all year if pasture is scarce.

6. Corn silage and mixed hay fed all year.

5. Corn silage fed in winter; grass silage fed in summer. Hay fed in winter - mixed hay fed in morning and alfalfa fed at night.

9. Corn silage fed all year except during good pasture. Hay fed all year.

2. Corn silage fed all year. Hay fed in winter and on low pasture.

8. Corn silage fed all year except on good pasture. Hay fed all year.

7. Corn silage fed all year. Grass silage fed with corn silage until pasture season. Hay fed all year.

22. Corn silage fed in winter. Grass silage fed in summer. Hay fed in winter.

11. Corn silage fed all year except when pasture is good. Hay fed all year.

3. Corn silage fed in winter. Alfalfa hay and corn stover fed in winter and fall.

4. Corn silage and grass silage alternated in winter. Grass silage fed in summer. Mixed hay fed all year.

21. Corn silage fed in fall and winter. Hay fed all year.

23. Corn silage fed in winter. Grass silage fed in summer. Hay fed all year.

16. Corn silage fed in winter and when pasture is poor. Hay fed all year.

14. Corn silage fed in winter. Grass silage fed in fall. Green feeds fed in summer. Hay fed in winter.

19. Corn silage fed in winter. Grass silage fed in summer. Hay fed all year. Fodder and straw sometimes fed.

Table XVI
(Continued)

Herd

17. Corn silage fed all year. Hay fed in winter.

10. Corn silage fed in winter. Grass silage fed in summer. Hay fed all year.

20. Corn silage fed in fall and winter. Hay fed in winter. Green feeds fed in late summer.

18. Corn and grass silage fed all year. Hay fed in winter. Green feeds fed in summer.

24. Corn silage fed in winter and fall. Hay fed in winter.

13. Corn silage fed in winter. Green feeds fed in summer. Hay fed in winter.

12. Corn silage all year. Chopped hay all year.

Table XVII shows the kind and amount of pasture in each herd.

Table XVII

Pasture

Herd

15. Twelve acres wood pasture, twenty acres permanent pasture, and fifteen acres temporary pasture. Cows and heifers pastured separately.

1. Twenty-five acres permanent blue grass pasture used at day. Eight acres of annual mixed pasture used at night. Wheat pastured in early spring. Cows and heifers pastured together.

6. Eleven acres permanent and six acres temporary pasture. Cows and heifers pastured together.

5. Ten acres permanent pasture. Wheat stubble and hay aftermath used for pasture. Dry cows and heifers pastured together but separate from milking cows.

Table XVII
(Continued)

Herd

9. No permanent pasture for milking cows. Pastures hay aftermath and wheat stubble. Dry cows and heifers pastured together on separate part of farm.

2. Twelve acres permanent, and ten acres rotated pasture. Hay aftermath pastured in fall. Heifers pastured separately from cows.

8. Four acres permanent pasture. Pasture supplemented with silage and hay. Heifers and cows pastured separately.

7. Twenty-nine acres permanent pasture divided into four parts and alternately pastured. Cows and heifers pastured separately.

22. Thirty-five acres of pasture. Cows and heifers pastured separately.

11. Eight acres of permanent pasture divided into two parts and alternatedly grazed. Cows and heifers pastured together.

3. Twenty-five acres permanent blue grass pasture for cows. Cows and heifers pastured separately.

4. Thirty acres permanent pasture divided into five parts which are alternately grazed. Heifers and cows pastured separately.

21. Fifty acres permanent pasture divided into four parts and alternately grazed. Cows and heifers pastured separately.

23. Twenty acres permanent pasture. Ten acres of hay aftermath grazed in fall. Cows and heifers pastured separately.

16. Seventy-five acres permanent pasture divided into night and day pastures. Cow and heifers pastured separately.

14. Forty-five acres permanent pasture. Cows and heifers pastured separately.

19. No pasture for milking cows. Dry cows and heifers pastured together.

17. Sixty acres permanent pasture divided into three parts - one for calves, one for heifers, and one for cows.

10. No permanent pasture for cows. Hay aftermath and wheat stubble grazed by milking cows. Heifers pastured.

Table XVII
(Continued)

Herd

20. Forty acres pasture divided in four parts and alternately grazed. Heifers and cows pastured together.

18. Eighty acres pasture divided into night and day pastures. Young heifers pastured in night pasture with cows. Older heifers pastured in day pasture with cows.

24. Three pastures. Cows and heifers rotated on pasture.

13. Forty acres permanent pasture. Cows and heifers pastured together.

12. Twenty-two acres permanent pasture and one hundred fifty acres wood pasture. Cows and heifers pastured together.

The differences in the feeding practices employed in these herds do not seem important enough to account for any differences in milk production.

Management of Dry Cows:
Drying off Procedures

Espe (5) recognizes sudden and complete cessation of milking together with controlled diet to be the most acceptable method of drying off cows.

As shown in Table XVIII, intermittant milking was employed in more than one-half of these herds to dry off cows. McLearen (9) found this method most commonly used in institutional herds. Incomplete milking was used in only one herd to dry off cows.

Table XVIII

Milking Practices Followed in Drying Off Cows

Milking Practice	Number of Herds	Per Cent of Herds
Intermittant Milking	14	58
Complete Cessation of Milking	9	38
Incomplete Milking	1	4

The feeding practices employed in drying off cows vary considerably among this group of herds. There are thirteen different practices used among the twenty-four herds. These are listed below in Table XIX.

Table XIX

Feeding Practice in Drying Off Cows

Number of Cases	
1	Change to dry grain and reduce silage several weeks before drying. Herd 21.
2	Change to dry grain and reduce silage several days before drying. Herds 2 and 18.
4	Change to dry grain at time of drying off. Roughage as usual. Herds 3, 5, 8, and 12.
3	Change to dry grain mix and reduce silage at time of drying off. Herds 13, 22 and 23.
3	Reduce grain at time of drying off. Roughage as usual. Herds 4, 14, and 17.

Table XIX
(Continued)

Number of Cases	
1	Reduce grain and silage at time of drying off. Herd 20.
1	Reduce grain and cut out silage at time of drying off. Herd 1.
1	Cut out grain several weeks before drying off. Roughage as usual. Herd 15.
1	Cut out grain several days before drying off. Roughage as usual. Herd 24.
2	Cut out grain at time of drying off. Roughage as usual. Herds 11 and 16.
3	Cut out grain and reduce silage at time of drying off. Herds 6, 9, and 19.
1	Cut out grain and silage several days before drying off. Herd 7.
1	Cut out grain and silage at time of drying off. Herd 10.

Changes in feeding methods vary from those that begin several weeks before drying off to those that begin just as drying off commences. Some herds change the amount or kind of roughage fed during the drying off period, while others feed roughage as usual. Some herds are shifted from the milking grain mix to the dry grain mixture, while in some herds the amount of the milking grain mixture fed is reduced, and in other herds all grain is omitted and roughage only is fed.

Table XX shows the drying off procedures in the various herds included in this study.

Table XX

Drying Off Procedures

Herd	Milking Method	Feeding Practice
15	Intermittant Milking	If persistent milker, keep in barn and feed only hay. For average cows, cut out grain 1 week before drying off. Feed roughage as usual.
1	Intermittant Milking	Reduce grain and cut out silage at time of drying off. If persistent milker, feed bran in place of grain mixture.
6	Intermittant Milking	Cut out grain and reduce silage at time of drying off.
5	Intermittant Milking	Change to dry grain at time of drying off. Feed 5 pounds grain daily. Feed roughage as usual.
9	Intermittant Milking	Cut out grain and reduce silage at time of drying off.
2	Intermittant Milking	Shift from milking to dry grain mixture and reduce silage to one-third a few days before drying off.
8	Intermittant Milking	Change to dry grain mix at time of drying off. Feed roughage as usual.
7	Complete Cessation of Milking	Cut out all grain and silage a few days before drying off.
22	Intermittant Milking	Shift to dry grain mix and reduce silage at time of drying off.
11	Intermittant Milking	Cut out all grain as soon as drying off begins. If persistent milker, cut out silage also.
3	Incomplete Milking	Shift to bran and oats and feed silage as usual at time of drying off.
4	Intermittant Milking	Reduce grain at time of drying off and feed roughage as usual.

Table XX
(Continued)

Herd	Milking Method	Feeding Practice
21	Complete Cessation of Milking	Shift to dry grain mix 3 weeks before drying off. Reduce silage one-half.
23	Complete Cessation of Milking	Shift to dry grain mix, reduce silage and feed hay at time of drying off.
16	Intermittant Milking	Cut out all grain at time of drying off. Feed roughage as usual.
14	Complete Cessation of Milking	Reduce grain at time of drying off. Cut out all feed if a persistent milker.
19	Intermittant Milking	Cut out all grain and reduce silage at time of drying off.
17	Complete Cessation of Milking	Reduce grain at time of drying off and feed roughage as usual.
10	Intermittant Milking	Cut out grain and silage as drying off starts.
20	Complete Cessation of Milking	Reduce grain and silage fifty percent at time of drying off.
18	Complete Cessation of Milking	Shift to dry grain mix several days before drying off. Reduce grain at time of drying off. Reduce silage also.
24	Complete Cessation of Milking	Cut out grain a couple days before drying off. Roughage fed as usual.
13	Intermittant Milking	Shift to dry grain mix at time of drying off. If persistent milker, cut out all grain and feed only hay.
12	Complete Cessation of Milking	Shift to dry grain mix. Feed roughage as usual.

Management of the Dry Cow

It is the common practice in these herds to allow the dry cows to remain with the milking cows, except for a short period ranging from two weeks to one day prior to calving when they are put into box stalls. In only three herds of the group are dry and milking cows kept separate. In herds 5 and 9, dry cows are transferred to a barn separate from the milking barn, and in herd 19. the dry cows are kept in a section of the milking barn separate from the milking cows. As a rule, the dry cows are pastured and housed together with the milking cows.

In all herds, with the exception of herd 9, some sort of grain is fed to dry cows in addition to pasture. In all herds grain is fed to dry cows in winter.

In seven of the twenty-three herds in which dry cows receive grain, the regular milking grain mix is fed during the dry period. In the remaining sixteen herds, dry grain mixture is fed. The amounts of grain fed vary from 4 to 10 pounds and silage is reduced during the dry period to one-half or one-third of the regular amount.

The cows in these herds are given a rest period, on the average of from 6 to 8 weeks in length. In herd 22, the cows are allowed the shortest rest period of any herd in the group, only 4 weeks.

Table XXI shows the management of the dry cows in the various herds of the group.

Table XXI

Management of Cows During Dry Period

Herd	Dry Period (Weeks)	Housing Methods	Feeding Practices
15	6	Remain with herd until 1 day before calving.	Dry grain mix. Silage as usual.
1	6-8	Fed separate from other cows. Occupy tie stalls in barn. Pasture with herd until just before calving.	4 pounds milk grain mix, one-half usual amount of silage.
6	4-6	Remain with herd until just before due to calve.	Small quantity of milk grain mix. About same roughage as usual.
5	6-7	Transferred to dry barn.	5 pounds dry grain mix and one-half usual amount of silage. Mixed hay fed.
9	4-6	Transferred to dry barn.	No grain or pasture. Dry grain mix, hay and stover fed in winter.
2	5-6	Remain with herd until several days before due to calve.	10 pounds dry grain mix, one-third usual amount of silage and plenty of alfalfa hay.
8	6-8	Remain with herd until 1 week before due to calve.	8-9 pounds dry grain mix, one-half usual amount of silage.
7	7	Remain with herd until day before calving.	12 pounds dry grain mix and usual amount of silage.
22	4	Remain with herd until 1 week before due to calve.	4 pounds dry grain mix and one-third of usual amount of silage, liberal amount of hay fed.
11	6	Remain with herd until 2 days before due to calve.	Dry grain mix and small amount of silage fed.

Table XXI
(Continued)

Herd	Dry Period (Weeks)	Housing Methods	Feeding Practices
3	6	Remain with herd until just before calving.	4 pounds milk grain mix. Usual amount of silage.
4	7	Remain with herd until 2 weeks before calving.	4 pounds milk grain mix and usual amount of silage.
21	6	Remain with herd until 3 days before calving.	4 pounds dry grain mix and one-half usual amount of silage.
23	6	Remain with herd until 1 week before calving.	Dry grain mix and small amount of silage.
16	6	Remain with herd until 1 week before calving.	5 pounds dry grain mix and one-half usual amount of silage.
14	6-8	Remain with herd until just before calving.	8 pounds milk grain mix and bran. Usual amount of silage.
19	6	Put into separate part of barn from herd.	Feed oats and bran. Small amount of silage. Sometimes pastured.
17	6-8	Remain with herd until 1 day before calving.	Restricted amount of milk grain mix. Usual amount of roughage.
10	6	Remain with herd.	Dry grain mix and usual amount of silage.
20	6	Remain with herd until 4 days before calving.	8 pounds milk grain mix and small amount of silage.
18	6-8	Remain with herd until 1 week before calving.	4 pounds dry grain mix and small amount of silage.

Table XXI
(Continued)

Herd	Dry Period (Weeks)	Housing Methods	Feeding Practices
24	8	Remain with herd until 1 week before due.	8 pounds of dry grain mix and usual amount of silage.
13	7-8	Remain with herd until 2 weeks before calving.	4 pounds dry grain mix until increase in flesh. Usual roughage.
12	6-8	Remain with herd until just before calving.	6 pounds dry grain mix and usual amount of roughage.

Management of Dry Cows at Calving Time

Among the herds of this group, the management methods of handling dry cows at calving time is variable, but differences are not outstandingly great.

Dry cows are separated from the milking cows and placed in box stalls for a period varying from one day to two weeks prior to calving, and are generally left in the box stalls for three or four days after calving. Silage and grain are reduced as the udder begins to become congested. A day or so before freshening, silage and grain are often entirely eliminated and hay is generally the only feed given until after calving, although bran is sometimes fed in addition to hay.

After freshening, grain is limited for about a week or more until the udder becomes normal. Bran is often fed for a few days and then the dry or milk grain mixture is fed for several days. After a period of light feeding, the milk grain mixture is gradually substituted for the dry grain mix and then gradually increased until the cow is on full feed. The period required to get the cows on full feed varies from one to five weeks, with an average of about three weeks in this group of herds.

Silage is generally not fed until the udder has lost its congestion. This practice varies, however. In some herds, cows are given silage at the next feeding following calving and in other herds cows are not fed silage until two weeks after freshening.

The management of dry cows at calving time in the various herds is shown in Table XXII.

Table XXII

Management of Cows at Calving Time

Herd	Just Before Calving	After Calving
15	Cut out silage as udder swells. Cut out grain day before due. Cows calve in box stall.	Feed light on milk grain mix, increase 1 pound daily. Full feed in 2 weeks. Silage at next feeding. Not milked dry for 2 days.
1	Shift from grain to bran 1 week before due. Cut out silage as udder swells. Cows calve in box stall.	Warm water after calving. Feed bran for 1 week and shift to milk grain mix. Full feed in 2 weeks. Silage at next feeding. Not milked for 24 hours.
6	Limited amount of milk grain mix. Decrease silage. Cows calve in box stall.	Plenty of water. Increase grain gradually and silage quickly. Full feed in 2 weeks. Not milked dry for 2 days.

Table XXII
(Continued)

Herd	Just Before Calving	After Calving
5	Change from dry grain mix to bran as udder swells. Reduce silage. Cows calve in box stall or strawshed.	Bathe udder with warm water. Feed bran or dry grain mix for 5 days, then move to main barn and feed milk grain mix. Full feed in 3 weeks. Milked at dry cow barn for 4 days.
9	At main barn 2 weeks before due. Dry grain mix fed up to 2 days before due. Cows calve in box stall.	Dry grain mix for 4 days. Give warm water after calving. Silage next feeding. Full feed in 2 weeks. Milked in 6 hours, but udder not milked dry.
2	Cut grain to one-half and reduce silage. Feed plenty of hay and water. Cows calve in box stall.	Give physic day before or after calving. Feed dry grain mix for 4 days, then milk grain mix. Full feed in 2 weeks. Milk in 12 hours but not milked dry for 3 milkings.
8	Reduce grain 2 weeks before due and cut out grain 2 days before. Cut out silage several days before calving. Cows calve in box stall.	Give dry grain mix for 1 week, then milk grain mix and gradually increase. Silage 2 days after calving. Full feed in 2 weeks. Milk in 12 hours.
7	Cut out corn silage 10 days before due. If feeding grass silage, feed until day before due. Cut out grain day before freshening. Cows calve in box stall.	Give salt water after calving. No grain for 24 hours. Dry grain mix for 2 weeks, then milk grain mix. No corn silage for 3 weeks Grass silage day after freshening. Full feed in 3 weeks. Not milked for 24 hours.
22	Feed dry grain mix up to calving. Cut out silage 1 week before due. Cows calve in box stall.	Dry grain mix for 5 days, then feed milk grain mix and increase gradually. Start feeding silage 5 days after calving. Full feed in 2 weeks. Not milked dry for 4 days.

Table XXII
(Continued)

Herd	Just Before Calving	After Calving
11	Cut out grain and silage 2 days before calving. Cows calve in box stall.	Give warm water after calving. Bran mash for 5 days and then milk grain mix. Silage 2 days after calving. Full feed in 2 weeks. Not milked for 24 hours.
3	Cut out grain just before calving. Give usual hay and silage. Cows calve in box stall.	Give small amount of grain for 1 week and then gradually increase. Full feed in 1 month. Milk dry 2 days after calving.
4	Cut out silage 2 weeks before due. Give grain up to calving. Cows calve in box stalls.	No grain or silage for 12 hours. Feed 4 pounds grain for 1 week and increase one-half pound daily. Full feed in 3 weeks. Milk 12 hours after calving.
21	Cut out silage 1 week before due. 2 pounds bran for 4 days before due. Cows calve in box stall.	Feed 2 pounds dry grain and 2 pounds bran for 2 days after calving. Feed dry grain mix for 1 week, then shift to milk grain mix. Give silage in 5 days. Full feed in 2 weeks. Milk dry 3rd milking.
23	Cut out dry grain mix and feed bran 10 days before due. Cut out silage 1 week before due. Cows calve in box stalls.	Bran for 1 week, dry grain mix for several days, then milk grain mix. Feed silage 5 days after freshening. Full feed in 3 weeks. Milk dry in 24 hours.
16	Reduce grain 1 week before due. Feed silage up to calving. Cows calve in box stalls.	Dry grain mix for 2 days, mix with milk grain mixture for 1 week, then give milk grain mix. Full feed in 2 weeks. Milk next day after calving.
14	Cut out grain and silage 2 days before due and feed bran. Cows calve in box stalls.	Bran for 2 days, then milk grain mix. Silage day after calving. Full feed in 2 weeks. Milk dry in 2 days.

Table XXII
(Continued)

Herd	Just Before Calving	After Calving
19	Cut out silage and feed bran as udder swells. Cows calve in box stalls.	Oats and bran for 1 week. Mix in milk grain mixture and cut out bran. Feed silage in a few days. Full feed in 1 month. Milk dry in 3 days.
17	Small amount of milk grain mix fed up to calving. Reduce amount of roughage. Cows calve in shed or pasture.	Limited grain until udder clears, then increase grain and silage. Full feed in 1 week. Milk at next milking period.
10	Cut out grain 2 days before due. Reduce silage at calving. Cows calve in stanchions, box stalls or pasture.	Small amount of dry grain mix fed after calving. Feed bran for 2 days. Increase silage immediately after calving. Full feed in 3 weeks. Milk dry in 2 days.
20	Cut grain in half or give laxative feed for 2 weeks before due to calve. Feed light on grain up to calving.	Feed light on laxative feed until udder clears, then feed milk grain mix and increase gradually. Increase silage as udder clears. Full feed in 3 weeks.
18	Feed bran with dry grain 1 week before due. Keep silage low. Cows calve in box stalls.	Feed half bran and half dry grain mix for 10 days. Then feed milk grain mixture and increase. Increase silage a few days after calving. Full feed in 3 weeks. Not milked dry for 3 milkings.
24	Reduce grain 2 weeks before due and mix with laxative feed. Cut out silage 4 weeks before due. Cows calve in box stalls.	Give bran for a few feedings, then give dry grain mix until udder clears and then feed milk grain mix. No silage for 2 weeks. Full feed in 4 weeks. Milk in 48 hours.

Table XXII
(Continued)

Herd	Just Before Calving	After Calving
13	Grain and silage fed until signs of calving shown. Reduce silage and feed bran a day or so before calving. Cows calve in box stalls.	Warm water and bran given for 2 days. Dry grain mix for 1 week, then milk grain mix fed. Silage in 2 days. Full feed in 2 weeks. Milked in 48 hours.
12	Cut out silage 2 weeks before due. Feed grain up to calving. Cows calve in box stalls.	Warm water in winter. Feed dry grain for 1 month then shift to milk grain mix. Silage in a day or so after calving. Full feed in 5 weeks. Milk next milking.

Dry Periods and Calving Intervals

The average length of the dry period given cows in the various herds is shown in Table XXIII. The length of dry period given in these herds varies from 6 to 9 weeks. Variation is quite pronounced among the herds of the group, and there does not appear to be any connection between the length of the dry period and the production level. The average dry period is about 8 weeks in length.

The average calving interval obtained in this group of herds varies from 11.8 to 14.0 months with the majority of herds having a calving interval of from 12 to 13 months. As can be seen, there appears to be no connection between the length of the calving interval and production level since both long and short calving intervals are found in the herds which rank in the upper levels of production as well as in the lower and medium levels.

Table XXIII

Dry Periods and Calving Intervals

Herd	Dry Period Desired (Weeks)	Dry Period Obtained		Calving Interval Obtained (Months)
		(Weeks)	(Days)	
15	6	7	1	13.4
1	6 to 8	9	4	13.0
6	4 to 6	6	0	13.4
5	6 to 7	7	4	12.5
9	4 to 6	6	4	12.1
2	5 to 6	6	2	13.3
8	6 to 8	8	2	12.1
7	7	7	2	12.6
22	4	-	-	12.5
11	6	6	5	14.0
3	6	9	1	12.4
4	7	8	4	12.7
21	6	6	5	12.8
23	6	8	2	12.4
16	6	6	4	11.8
14	6 to 8	7	5	13.3
19	6	8	1	13.8
17	6 to 8	7	1	12.2
10	6	8	1	12.5
20	6	6	4	13.4
18	6 to 8	7	5	12.0
24	8	-	-	13.2
13	7 to 8	8	0	12.6
12	6 to 8	7	5	12.6

Management of Heifers

Heifers are kept in the milking barn during the winter months in all but eight herds. When kept in the milking barn, the heifers occupy either stanchions among the cows or tie stalls or box stalls separate from the cows. In seven herds, a separate barn is provided for housing heifers and in one herd, they are allowed to run loose in an open shed connected to the milking barn.

During the winter months, the heifers in all herds except herd 17 receive grain, silage and hay. In seven herds, the milk grain mix is fed to heifers while in the rest of the herds the dry or calf grain mix is fed.

During the pasture season, the heifers are pastured according to three plans: (1) some herd managers pasture heifers and dry cows together but separate from the milking cows; (2) some pasture heifers separate from all cows; while (3) others pasture heifers and cows together.

In only eight herds is grain fed to heifers daily on pasture. If the heifers pasture with the cows, they are fed grain at the barn; if they pasture separate from the cows, they are fed grain in the pasture.

With the exception of these eight herds feeding grain daily, grain is usually fed only on scanty pasture. Some silage and hay may also be fed at this time.

The ages of pasturing heifers among this group of herds range from six months to one year.

The management of heifers during the winter months in the various herds is shown in Table XXIV.

Table XXIV

Heifer Management
(Winter)

Herd

15. Heifers occupy stanchions in the cow barn in winter and are fed dry grain mix, a limited amount of silage and plenty of hay.

Table XXIV
(Continued)

Herd

1. Heifers occupy tie stalls in the cow barn and do not get into stanchions until after calving. Milk grain mix, hay and silage are fed in winter.

6. Heifers occupy stanchions in cow barn and are fed milk grain mix, hay and silage.

5. Heifers are kept at a barn separate from the main barn. They remain at this barn until after calving. In winter, they receive dry grain mix, hay and silage.

9. Heifers are kept at a barn separate from the main barn. They are taken to this barn at 6 months of age and remain there until 2 weeks before calving. Here they are fed grain, fodder, silage and hay in winter.

2. Heifers are kept in box stalls and stanchions in the cow barn in winter. They are fed dry grain mix, silage and hay.

8. Heifers are kept in box stalls and stanchions in the cow barn in winter and receive dry grain mix, hay and silage.

7. Heifers are kept in a barn separate from the cow barn. They are fed milk grain mix, shredded fodder, hay and silage.

22. Small heifers occupy box stalls, large heifers occupy stanchions in the main barn in winter. They receive dry grain mix, silage and hay.

11. Heifers occupy box stalls and stanchions in cow barn. They are fed milk grain mix, hay and silage.

3. Heifers occupy the stalls in the main barn in winter. They are fed oats and bran, corn silage and hay.

4. Heifers occupy stanchions in barn among the cows and also in another part of the barn. They are fed milk grain mix, hay and silage.

21. Heifers are kept in a barn separate from main barn. They receive dry grain mix, hay and silage.

23. Heifers occupy box stalls in main barn and are fed dry grain mix, hay and silage.

Table XXIV
(Continued)

Herd

16. Heifers are kept at a barn away from main barn and are fed dry grain mix, small amount of silage, and hay.

14. Heifers are kept at a barn away from main barn and receive mixed hay, small amounts of silage and dry grain mix.

19. Heifers occupy box stalls in the main barn. They receive a special grain mix, silage and hay.

17. Heifers are kept loose in an open shed adjoining the cow barn. They receive no grain in the winter but get hay and silage.

10. Heifers occupy stanchions in barn with cows in winter. They are fed dry grain mix, hay and silage.

20. Heifers occupy box stalls and stanchions in the cow barn and are fed small amounts of silage, hay and milk grain mix.

18. Heifers are kept in stanchions in the cow barn, but not among the cows. They are fed hay, dry grain mix and a little bit of silage.

24. Heifers are kept in box stalls and stanchions in the main barn and are fed dry grain mix, small amounts of silage and hay.

13. Heifers are kept in barn separate from cow barn and are fed calf grain mix, hay and silage.

12. Heifers are kept in the main barn in stanchions, but separate from the cows. They are fed dry grain mix, silage and hay.

The management of heifers on pasture in these herds is shown in Table XXV.

Table XXV

Heifer Management
(Summer)

Herd

15. Heifers pasture at 6 months of age with cows and are fed dry grain mix. Yearling heifers are pastured away from the herd on a separate pasture. They receive no grain on pasture.

Table XXV
(Continued)

Herd

1. Heifers are pastured generally at 1 year of age except fall calves which go on pasture the following spring. Heifers pasture with the cows and come to the barn. They are not fed grain on pasture.

6. Heifers pasture at the age of 6 months with the cows and are fed milking grain daily in the barn.

5. Heifers pasture at the age of 1 year with the dry cows, separate from the milking cows. No grain is fed on pasture.

9. Heifers pasture at 6 months of age with the dry cows separate from the milking herd. Grain is fed only if pasture is poor.

2. Heifers remain at the barn until 1 year of age and may be pastured in a nearby lot. At 1 year of age they are put on pasture separate from the other stock. Heifers are generally bred before going to pasture. Grain is not fed on pasture.

8. Heifers turned on pasture at age of 1 year. Up until August they are pastured separately from the cows. When pasture gets poor, they are put with the cows and are fed dry grain. Otherwise grain is not fed on pasture.

7. Heifers pasture at 6 to 8 months of age in a separate pasture from the cows. They receive small amounts of milking grain on pasture.

22. Heifers are pastured at 10 months of age separately from the cows. Small amounts of dry grain are fed daily on pasture.

11. Heifers are pastured at 1 year of age with the cows. They come to the barn daily and are fed milk grain mix.

3. Heifers pasture separately from the cows at 10 months of age. Grain is usually fed on pasture. Hay is fed if pasture is short. They do not come to the barn in summer.

4. Heifers pasture at 7 months in a modified Hohenheim system where at the first of the season they precede the cows and then later on follow the cows. They receive grain daily at the barn. Silage is generally fed on poor pasture.

21. Heifers are pastured at the age of 1 year separately from the cows. No grain is fed on pasture.

Table XXV
(Continued)

Herd	
23.	Heifers pasture separately from the cows at the age of 1 year. No grain is fed on pasture.
16.	Heifers pasture at the age of 7 months separately from the cows. No grain is fed on pasture.
14.	Heifers pasture at the age of 8 months separately from the cows. They alternate between two pastures. No grain is fed on pasture.
19.	Heifers pasture at the age of 1 year (cows are not pastured). Grain and silage are fed to heifers on low pasture.
17.	Heifers pasture at 9 months in lot near barn. At 1 year they pasture away from the barn but not with the cows. Dry grain is fed on short pasture.
10.	Heifers pasture in lot near the barn with access to a self-feeder until 1 year of age. At that age they are put on pasture separate from the cows. No grain is fed on pasture.
20.	Heifers pasture at age of 1 year with the cows. They remain on pasture in the summer and receive no grain.
18.	Heifers pasture at the age of 6 months in small lot near the barn. At 1 year of age they are put in the pasture with the cows. No grain is fed on pasture.
24.	Heifers are pastured at 1 year of age. At first they pasture with the cows and later on as pasture gets short they follow the cows. Dry grain is fed daily at the barn.
13.	Heifers pasture at 1 year of age, separate from the cows at first and then later on in the season pasture with the cows. No grain is fed to heifers on pasture.
12.	Heifers pasture at 1 year of age with the cows. No grain is fed to heifers except in fall when pasture is poor. Silage is also fed at this time.

Preparing Heifers for Calving

In those herds where heifers pasture separately from the cows, the heifers are generally put in the same pasture with the cows a short time before they are due to freshen and are fed grain in the barn. The period of grain feeding varies in length among the different herds in the group. In some herds grain feeding is started as long as six weeks before heifers are due to calve, in some herds heifers are fed grain continuously, while in others grain feeding is started only a few days before calving.

Eckles (4) recommends to start feeding grain to heifers three months before calving. Although this practice is not followed in the majority of herds, the heifers are generally in good condition at time of calving.

The different practices followed in preparing heifers for calving in these herds are shown in Table XXVI.

Table XXVI

Preparing Heifers for Calving

Herd	
15.	Heifers are put with cows, brought to barn and fed dry grain mix 6 weeks before due.
1.	Heifers are brought to barn and fed milk grain mix 4 weeks before due.
6.	Heifers are grained daily in barn.
5.	Heifers remain at dry barn until after calving. Springing heifers are fed dry grain mix at dry barn.
9.	Heifers go with cows and are brought to barn 2 weeks before due to freshen. Grain is not fed in summer.
2.	Heifers are brought to barn and put in box stall 2 days before calving. Dry grain mix is fed.

Table XXVI
(Continued)

Herd

8. Heifers are put with cows and brought to barn 1 month before calving. Dry grain mix is fed.

7. Heifers are put with cows and brought to barn 3 weeks before calving. Dry grain mix is fed.

22. Heifers are put with cows and brought to barn 2 weeks before calving. Dry grain mix is fed.

11. Heifers are in barn with cows and fed dry grain mix all the time.

3. Heifers are put with cows and brought to barn 1 months before calving. Milk grain mix is fed.

4. Heifers are put with cows at 18 months of age and fed milk grain mix daily.

21. Heifers calve at heifer barn and brought to milking barn after calving. Dry grain mix is fed to springing heifers.

23. Heifers are put with cows and brought to barn 2 weeks before calving. Dry grain mix is fed.

16. Heifers are put with the cows and brought to the barn 2 months before they are due to calve. Dry grain mix is fed.

14. Heifers are put with cows and brought to barn 1 month before they are due to freshen. Dry grain mix is fed.

19. Heifers brought to barn several days before they are due to calve and fed grain.

17. Heifers brought to barn and fed grain 2 weeks before due to freshen.

10. Heifers put with cows and brought to barn 2 days before due to freshen.

20. Heifers with cows daily and fed light on grain 2 weeks before due to calve.

18. Heifers with cows daily and 2 weeks before due to freshen, are fed bran and dry grain mix.

24. Heifers with cows daily and fed dry grain mix.

Table XXVI
(Continued)

Herd

13. Heifers put with cows and brought to barn 6 weeks before due to freshen and fed grain.

12. Heifers brought to barn 3 days before due to calve.

Age of First Calving

According to literature (4, 6, 12, 13) optimum milk production is obtained by breeding normally developed Holstein heifers to calve at 28 to 30 months of age. The average age of first calving of Holstein heifers in Iowa D.H.I.A. herds was found to be 27.2 months (8). Heifers in institutional herds (9) were found to calve at 27 to 33 months of age.

In Table XXVII is shown the desired ages of first calvings and the actual ages of first calvings for the various herds included in this study.

Ages of first calvings vary from 25 to 33 months. The majority of her managers breed their heifers to calve at about 28 to 30 months of age. There does not appear to be enough difference between the calving ages of heifers in these herds to materially affect their production.

Table XXVII

Age of First Calving

Herd	Age Desired (Months)	Actual Age (Months)
15	24	28

Table XXVII
(Continued)

Herd	Age Desired (Months)	Actual Age (Months)
1	25	28
6	25	27
5	29	29
9	28	29
2	24	30
8	24	27
7	27	28
22	27	27
11	26	28
3	27	29
4	27	31
21	26	30
23	24	28
16	27	29
14	26	26
19	25	-
17	24	25
10	28	29
20	29	30
18	26	26
24	31	33
15	28	28
12	28	28

Calf Management Practices

There is a considerable amount of variation among the practices followed in raising calves in the various herds. However, all these practices seem to fulfill the fundamental principles of calf raising as set forth by McLearen (9). These are (1) careful feeding, (2) strict sanitation, and (3) proper housing.

The various practices followed in raising calves are shown in Tables XXVIII and XXIX.

The length of time calves are left with their dams varies from no days at all in two cases to ten days. The average length of time is estimated at four days. In the two herds, 18 and 15, which do not allow the calves to remain with their dams after birth, the colostrum is fed from a bucket.

Nine herds of the group feed skim milk after a period of whole milk feeding ranging from five days to six weeks. Skim milk is fed thereafter for a period of three to six months.

In the herds which do not feed skim milk, whole milk is fed for a period of from two to nine weeks.

In all herds, the calves are fed grain. Grain feeding commences as soon as the calf will eat and is continued until the calf goes to pasture.

In seven herds of the group a special calf grain mixture is fed for three to four months and then a dry or milk grain mix is fed.

In six herds calf grain mix is fed for the entire grain feeding period.

In ten herds only a dry grain mix is fed to calves and in one herd calves receive only a milk grain mixture.

Some herd managers feed silage to calves as early as one week after birth, while others do not feed silage until calves are one year of age. As a general rule, however, silage is fed in small amounts to calves after they are about four to six months of age.

Pasturing ages vary from six months to one year.

Calves are generally kept in box stalls in the main barn. However, some herdsmen keep their calves in a barn with the heifers and separate from the main barn.

Housing conditions for calves are generally quite good in all the herds studied.

Table XXVIII

Management of Calves
(Milk and Grain Feeding)

Herd	Days With Dam	Milk Fed (Pounds)	Grain Fed (Pounds)
15	0	Colostrum in bucket, 12 pounds whole milk for 5 months.	Calf grain mix for 3 months. Dry grain mix until turned on pasture.
1	5	12 pounds whole milk for 6 weeks.	Calf meal for 4 months. Milk grain mix until turned on pasture.
6	6	12 pounds whole milk from low testing cow for 3 months.	Calf grain mix until turned on pasture.
5	4	8 pounds whole milk for 2 weeks.	Calf grain mix for 3 months. Dry grain mix until turned on pasture.
9	4	Skim milk at 1 week for 3 months.	Calf grain mix for 6 months. Dry grain mix until turned on pasture.
2	4	12 pounds whole milk for 9 weeks.	Calf grain mix until turned on pasture.
8	4	12 pounds foremilk for 5 months.	Dry grain mix until turned on pasture.
7	4	Whole milk for 8 weeks. Dilute with water and eliminate.	Calf grain mix for 3 months. Milk grain mix until turned on pasture.
22	4	12 pounds whole milk for 3 months.	Dry grain mix until turned on pasture.
11	5	12 pounds whole milk for 5 months.	Dry grain mix until turned on pasture.

Table XXVIII
(Continued)

Herd	Days With Dam	Milk Fed (Pounds)	Grain Fed (Pounds)
3	10	8 pounds whole milk for 5 months.	Calf grain mix until turned on pasture.
4	4	14 pounds skim milk for 7 months.	Calf grain mix until turned on pasture.
21	4	10 pounds whole milk for 3 weeks. Skim milk for 6 months.	Dry grain mix until turned on pasture.
23	1	8 pounds whole milk for 6 weeks. Skim milk for 6 months.	Calf grain mix until turned on pasture.
16	1	10 pounds whole milk for 2 months.	Calf grain mix until turned on pasture.
14	3	12 pounds whole milk for 6 weeks.	Calf grain mix for 6 months. Dry grain mix until turned on pasture.
19	3	12 pounds whole milk for 3 months.	Whole oats and calf grain mix until turned on pasture.
17	1	Whole milk for 2 weeks. Powdered milk for 4 months.	Dry grain mix until turned on pasture.
20	10	12 pounds whole milk for 6 months.	Milking grain mix until turned on pasture.
10	7	10 pounds whole milk for 1 month. Skim milk for 3 months.	Dry grain mix until turned on pasture.
18	0	Colostrum in bucket. 12 pounds whole milk for 3 weeks. Skim milk for 3 months.	Dry grain mix and oats until turned on pasture.
24	7	8 pounds whole milk for 6 weeks.	Calf grain mix for 4 months. Dry grain mix until turned on pasture.

Table XXVIII
(Continued)

Herd	Days With Dam	Milk Fed (Pounds)	Grain Fed (Pounds)
13	3	Whole milk for 5 days. Skim milk for 6 months.	Calf grain mix until turned on pasture.
12	2	Whole milk for 1 month. Skim milk for 4 months.	Dry grain mix until turned on pasture.

Table XXIX

Management of Calves
(Roughage Feeding and Housing)

Herd	Roughage Fed (Pounds)	Pasture	Housing
15	Silage at 3 weeks. Liberal hay.	Pasture at 6 months.	Box stalls in barn until turned on pasture. Not housed on pasture.
1	Silage at 7 months, until 1 year old.	Pasture at 1 year.	Box stalls in horse barn and tie stalls in cow barn.
6	Liberal hay. Silage at 1 week.	Pasture at 6 months.	Box stalls in cow barn.
5	Liberal hay. Silage at 3 months.	Pasture at 1 year.	Box stalls and pens in cow barn.
9	Liberal hay. Silage at 3 months.	Pasture at 6 months.	Box stalls in cow barn for 6 months. At dry barn after 6 months.
2	Liberal hay. Silage at 1 year.	Pasture at 1 year.	Box stalls and tie stalls in cow barn.
8	Liberal hay. Silage at 1 month.	Pasture at 1 year.	Box stalls in cow barn.
7	Liberal hay. Silage at 3 months.	Pasture at 8 months.	Box stalls in cow barn.

Table XXIX
(Continued)

Herd	Roughage Fed (Pounds)	Pasture	Housing
22	Liberal hay. Silage at 10 months.	Pasture at 10 months.	Box stalls in cow barn.
11	Liberal hay. Silage at 1 week.	Pasture at 1 year.	Box stalls in cow barn.
3	Liberal hay. Silage at 8 months.	Pasture at 10 months.	Box stalls in cow barn.
4	Liberal hay. Silage at 1 week.	Pasture at 7 months.	Box stalls in cow barn. Stanchions at 7 months.
21	Liberal hay. Silage at 1 year.	Pasture at 1 year.	Stalls in calf barn.
23	Liberal hay. Silage at 10 months.	Pasture at 1 year.	Box stalls and pens in cow barn.
16	Liberal hay. Silage at 4 months.	Pasture at 7 months.	Box stalls in cow barn.
14	Liberal hay. Silage at 6 months.	Pasture at 8 months.	Box stalls in cow barn.
19	Liberal hay. Silage at 6 months.	Pasture at 1 year.	Stalls in calf barn.
17	Liberal hay. Silage at 2 months.	Pasture at 9 months.	Box stalls in cow barn.
20	Liberal hay. Silage at 1 week.	Pasture at 1 year.	Box stalls in cow barn.
10	-------------	Pasture at 1 year	Box stalls in barn.
18	Liberal hay. Silage at 6 months.	Pasture at 6 months.	Box stalls in barn.
24	Liberal hay. Silage at 7 months.	Pasture at 1 year.	Box stalls in barn.
13	Liberal hay. Silage at 6 months.	Pasture at 1 year.	Box stalls in cow barn. Stalls in heifer barn.
12	Liberal hay. Silage at 1 year.	Pasture at 1 year.	Box stalls and pens in cow barn.

Management of Sire

In all herds except herd 2, the herd sire is housed on the premises. Housing conditions vary from the use of box stalls in the milking barn to the use of a small shed or building in the barn yard. In no case is the sire allowed on pasture, and he is kept separate from the cows and other livestock at all times. In a very few cases are there special arrangements for breeding. Breeding generally occurs in the open barn yard or bull pen.

In fifteen of these herds bull association sires are used and in the remaining nine herds, the sires are owned individually.

Feeding practices vary among the different herds. Some herdsmen feed dry grain mixes, some feed milk grain mixes, while others feed no grain at all to sires. Some herdsmen feed silage to the sire, while others do not feed silage. All sires receive hay. The majority of herdsmen feed four to eight pounds of either dry or milk grain mixtures, ten to twenty pounds of silage and plenty of hay to their herd sires.

Table XXX shows the housing and feeding of the sires in each herd.

Table XXX

Sire Management

Herd

15. Bull association sire. Housed in a pen at the side of the cow barn. Cows bred in open yard back of barn. Fed 8 pounds dry grain mix which is increased during heavy breeding.

1. Bull association sire shared with farm 2. Housed in large pen in end of cow barn. Cows bred in barn yard. Fed 4 pounds milk grain mix, hay and 30 pounds silage.

Table XXX
(Continued)

Herd	
6.	Bull association sire. Housed in box stall in cow barn. Small yard attached to stall. Cows bred in box stall. Fed 4 pounds milk grain mix, 15 pounds silage and the hay left by calves.
5.	Bull association sire. Housed in small shed in barn yard. Cows bred in barn yard. Fed 12 pounds milk grain mix, 30 pounds silage and no hay.
9.	Individually owned sire, kept in stall in horse barn. Cows bred in barn yard. No grain is fed. Only fodder and hay.
2.	Bull association sire shared with farm 1 and kept at farm 1. Bull is lead from farm 1, a distance of 3 miles, for each breeding.
8.	Bull association sire leased from U.S.D.A. Housed in pen in back of cow barn. Has yard attacked to pen. Cows bred in yard. Fed 5 pounds dry grain mix, 20 pounds silage and hay.
7.	Bull association sire. Housed in pen adjoining barn. Small lot attached for breeding and exercise. Fed 6 pounds milking grain mix, 10 pounds silage and hay.
22.	Individually owned sire. Housed in pen connecting barn. Small lot attached for breeding and exercise. Fed 4 pounds dry grain mix, 10 pounds silage, and plenty of hay.
11.	Individually owned sire. Housed in pen in end of barn. Cows bred in barn yard. Fed small amount of milking grain mix, 10 pounds silage, and plenty of hay.
3.	Bull association sire. Kept in shed in barn yard. Small lot attached for breeding and exercise. Fed 2 pounds chopped oats, 10 pounds silage and hay.
4.	Bull association sire. Kept in box stall in barn. Yard attached for exercise and breeding. Fed 4 pounds milking grain mix, hay but no silage.
21.	Individually owned sire. Kept in stanchion in main barn. Cows bred in barn yard. Fed 4 pounds dry grain mix, 30 pounds silage, and plenty of hay.
23.	Individually owned sire. Bull is staked out in summer. Kept in box stall in winter. Cows bred in barn yard. Fed 4 pounds dry grain mix, hay and silage.

Table XXX
(Continued)

Herd

16. Bull association sire. Generally housed in stanchion in barn. Uses small lot in back of barn for exercise. Cows bred in barn yard. Fed 4 to 5 pounds dry grain mix, little silage and plenty of hay.

14. Bull association sire. Housed in pen on side of barn. Yard attached for breeding and exercise. Fed milking grain mix, small amount of silage and abundant amount of hay.

19. Bull association sire. Housed in box stall in horse barn. Cows bred in barn yard. Fed 8 pounds calf grain mix, mixed hay but no silage.

17. Individually owned sire. Kept in box stall in horse barn. Cows bred outside of barn. Fed 6 pounds milking grain mix, 20 pounds silage and small amount of hay.

10. Individually owned sire. Kept in stall in horse barn. Cows bred in barn yard. Fed 5 pounds milking grain mix, liberal amount of hay, but no silage.

20. Individually owned sire. Kept in box stall in cow barn. Cows bred in barn yard. Fed 5 pounds milking grain mix, 20 pounds silage and hay. Often staked out in summer.

18. Individually owned sire. Kept in stall in horse barn. Cows bred outside of barn. Fed 6 pounds dry grain mix, little silage and liberal amount of hay.

24. Bull association sire leased from U.S.D.A. Kept in pen in end of barn yard. Yard attached for breeding and exercise. Fed 8 pounds dry grain mix, hay, but no silage.

13. Bull association sire. Kept in pen in horse barn. Lot attached for exercise and breeding. Fed 3 pounds dry and 3 pounds milking grain mix, small amount of silage and plenty of hay.

12. Bull association sire. Kept in stall in horse barn. Occupies pen and shed back of barn in summer. Cows bred in pen back of barn. Fed 6 pounds dry grain mix and oats. No silage and 10 pounds hay.

SUMMARY OF RESULTS

Records pertaining to production, feeding, and breeding of the milking cows are complete in the majority of herds. Records concerning the management of heifers from birth to freshening are usually incomplete, the only records kept being that of their birth and, in some instances, a record of their breeding. Records on herd sires are also very incomplete in these herds.

Records kept in private herds are much less complete than those kept in Institutional herds. As previously pointed out, Institutional herd managers keep records in addition to those kept by the Dairy Herd Improvement Association tester. This practice is not practical for the average dairyman. The only records available on private herds are those kept by the Association testers.

Private herds are generally managed by the owners. Only one herd of the group was under the management of a herdsman. Two herds were managed jointly by the owners and another party. The other twenty-one herds were all owned and operated by the same persons.

Dairying is only one of several enterprises with the majority of these dairymen. General farming is carried on in addition to dairying and in most cases is of equal importance to dairying in the way of returns. Therefore, it can be expected that the private herds will receive less attention than Institutional herds which are under the management of a herdsman whose only duty is to attend to the herd.

Special training in dairying is often lacking among the management of private herds. Information is gathered from experience and from farm journals. The dairymen have generally all been in the dairy business for many years, the majority having been dairying all their life.

The private herds included in this study are scattered over the State of Pennsylvania and there is a good representation of the various farming sections. The location of herds 12 and 13 might have some effect upon their level of production due to their being located in an area where the soil is too poor for good crop production.

Nineteen of these herds ship their milk to creameries while the other five herds retail milk to the consumers of the community.

The barns are generally of two stories and built on a slope. Animals are housed in the basement and feed is stored on the second floor. In some cases, all farm stock are kept in the same barn, the milking stable being separated from the other stables by solid partitions. As a rule, the stables are poorly lighted and ventilated.

The herds range in size from 12 to 33 cows with an average size of 21 cows. The average milk production per cow varies from 7,899 pounds of milk to 12,557 pounds yearly, with an average of 10,380 pounds.

Private herds are much smaller than Institutional herds. They are of the appropriate size to enable the manager to carry on other types of farming, in addition to dairying, without the necessity of hiring extra men. Although there has been an increase in average size of private herds and an increase in total production, the average production per cow has not materially changed over the five-year period studied. This is an indication that the additions to the herds are not superior to the animals which they replace.

The largest percentage of milk is produced in the spring months on good pasture. In the fall when pastures are poor and there are quite a few dry cows, production is lowest. The period from February to May is above average in production of milk. From June to January the production is below average.

The majority of these herds have the largest percentage of cows freshening during the fall and winter months, but this practice is quite variable.

Additions consist mostly of heifers raised from the cows in the herd. In only a very few cases are animals purchased into the herd.

Disposals consist mostly of animals sold for dairy purposes and animals disposed of due to Bang's disease.

Culling out of low producing cows is not very commonly practiced. The herd owners appear to be more willing to sell one of their good cows to some one for dairy purposes than get rid of some of their low producers.

The age of the cows in these herds varies from 3 years and 6 months to 7 years with an average age of 4 years and 11 months.

All herds of the group are milked two times daily. Milking machines are used in the majority of herds. In five herds the milking is done by hand.

In agreement with Wayne et al (14) and McLearen (9) the intermittant type of milking in drying off cows was used in most of the herds. Incomplete milking was used least of all.

The feeding practices followed in the different herds during the drying off period are quite variable, there being thirteen different practices in use among the twenty-four herds.

Dry cows are generally not separated from the milking herd during the dry period. All cows receive either dry or milk grain mixtures during the dry period. Cows are given 6 to 8 weeks rest between lactations making the calving interval 12 to 13 months in length.

In most all herds, dry cows are put in box stalls several days before they are due to freshen. Grain and silage are often withheld a day or two just before calving. Grain is usually limited for a week or more after calving. It is the general practice to feed bran a day or so before calving and for several days after calving. Silage is generally not fed until the udder has lost its congestion.

Heifers are generally kept in box stalls or stanchions in the milking barn. Sometimes they are pastured with the cows and sometimes they are put in a pasture by themselves. Grain is not always fed on pasture. It is the general rule not to grain heifers until the pasture becomes short and dry. A dry grain mix is fed in some cases and a milk grain mix in other cases. Heifers are first put on pasture at ages varying from 6 months to 1 year.

First calf heifers are treated similarly to dry cows just prior to calving. Grain feeding usually begins a week or more before the heifer is due. Heifers are placed with the milking cows a week or more prior to freshening and are put in box stalls a day or two before calving.

Age of first calving varies from 25 to 33 months, with an average of 29 months.

The principles of proper calf raising appear to be followed in all the herds included in this study.

In two herds, the calves are not permitted to suck their dams. However, in these herds, the colostrum is given to the calves by means of a bucket. In other herds, the calves remain with their dams for periods varying from 1 to 10 days.

Skim milk is fed to calves after a period of whole milk feeding in only nine of the herds. In the other herds, whole milk is the only milk fed to calves.

Grain is fed to calves as soon as they will eat it. Four practices of grain feeding are followed: (1) in seven herds a special calf grain mixture is fed for a while, followed by a dry or milk grain mix; (2) in six herds a calf grain mix is fed for the entire grain feeding period; (3) in ten herds dry grain mix is fed for the entire period; and (4) in one herd only milk grain mixture is given to calves.

As a general rule, silage is fed to calves at about the age of 4 to 6 months, although in some herds, silage feeding commences as early as two weeks of age, while in others, silage is not fed until calves are 1 year old.

Hay is fed liberally to calves in all herds.

As a rule, calves are kept in box stalls in the main barn. There are a few herds in which the calves are kept in a separate barn with the heifers.

Bull association sires are used in fifteen herds. Privately owned sires are used in the other nine herds. Sires are housed in box stalls in the main barn or are kept in specially constructed sheds or pens in the barn yard. Breeding racks are used in only a few herds. The cows in the majority of cases are bred in the barn yard.

Sires in eleven herds receive a milk grain mixture, eleven other sires are fed a dry grain mix, and one sire receives no grain at all. In seven of the twenty-four herds, the sires do not receive grain. All sires are fed hay. In no cases are the sires pastured.

The majority of sires receive 4 to 8 pounds of either dry or milk grain mixtures, 10 to 20 pounds of silage, and plenty of hay.

Most of these herds have three separate grain mixtures. A milk grain mix is fed to the milking cows. A dry cow grain mix is generally fed to dry cows, heifers, and sires. A commerical calf grain mixture is generally fed to calves for a short period followed by a dry grain mixture. However, in some herds a milk grain mixture is fed to all stock but calves, while in other herds a milk grain mixture is fed to all stock including calves.

Corn silage is fed in all herds, and in a few herds grass silage is fed during the summer. Silage is usually fed only during fall and winter months.

Alfalfa and mixed hay comprise the major portion of the hay fed in these herds.

All except a few herds provide pasture to milking cows. In these herds which have no pasture, hay, silage and green feeds are fed in summer.

CONCLUSION

The management practices followed in the private herds included in this study do not differ greatly from those followed in Institutional herds.

The herd managers seem to be following the practices most suited to their individual cases without omitting any of the more important aspects of proper management. Although differences in management methods between herds are evident, these differences are not so important as to have any marked influence on the milk production in the various herds.

This study offers an excellent cross-section of the management methods followed in purebred Holstein herds of Pennsylvania.

It would appear that the most important factor causing a difference in the milk production of these herds lies in the inheritance of the animals comprising the herds rather than in the management methods followed in the herds.

APPENDIX

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OWNERS AND ADDRESS OF HERDS

1. D. Q. Adams - Mifflintown, Pa.
2. Theoreus Kauffman - Mifflintown, Pa.
3. T. F. McClure - Port Royal, Pa.
4. A. R. Bradley, Manager - Mill Hall, Pa.
5. L. M. Kyle - Mackeyville, Pa.
6. I. V. Otto - Carlisle, Rt. 6, Pa.
7. G. Weir Streck - Mechanicsburg, Pa.
8. W. R. Milligan - Leysville, Pa.
9. R. F. Erdley - Lewisburg, Pa.
10. R. E. Musser - Lewisburg, Pa.
11. Wm. J. Erdley - Mifflinburg, Pa.
12. Elmer Anderson - Ridgway, Pa.
13. H. J. Gregory - St. Marys, Pa.
14. C. A. McCauley - New Bethlehem, Pa.
15. Roy S. Bowen - Wellsboro, Pa.
16. R. H. Fleming - Troy, Pa.
17. K. A. Browning - Wyalusing, Pa.
18. F. E. Olver - Honesdale, Pa.
19. F. R. Sheek - Pen Argyl, Pa.
20. I. S. Gross - Plumsteadville, Pa.
21. J. L. Wood & Son - Pennsburg, Pa.
22. F. A. Keen - West Chester, Pa.
23. H. M. Cater - Hummelstown, Pa.
24. Beaver Brothers - Millerstown, Pa.

End of Title